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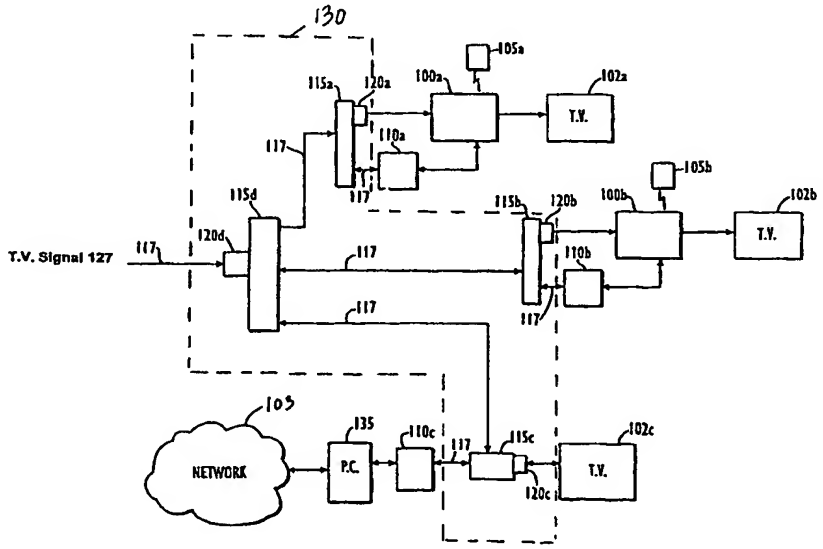

(57) Abstract

A set–top box is provided wherein an Identifier (ID) associated with the set–top box can be used to request information from a personal computer which provides the requested information to the set–top box. In particular, in a system that includes multiple set–top boxes, the ID can be used to determine which set–top box made a request and to determine which set–top box is the intended recipient of the requested information accessed by the system. The information can be provided over a cable which is used to connect a television signal. In particular, the information can be transferred using frequency shift keying modulation.

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METHODS AND SYSTEMS FOR PROVIDING INFORMATION TO SET-TOP BOXES HAVING SET-TOP BOX IDENTIFIERS USING FREQUENCY SHIFT KEYING MODULATION

Field of the Invention

The present invention relates to the field of communications in general, and more particularly, to data transmission.

Background of the Invention

The television (TV) has become ubiquitous in modern society. As a result, a variety of services are being provided via TV. Many of the services are provided using a set-top box that works in conjunction with the TV to provide the desired service. One example of a service provided via a TV is an online TV program guide, wherein TV program schedule information is displayed on a TV for searching and selection by a viewer. Online TV program guides are described in U.S. Patent 4,751,578 to Reiter et. al. entitled *System for Electronically Controllable Viewing on a Television Updateable Television Programming Information.* Other popular services are also provided using a set-top box. For example cable or satellite TV may be provided using a tuner packaged as a set-top box. The tuner decodes the transmission from the service provider and formats the signal for display on the TV. Moreover, many households have more than one TV.

It is also known to provide some services over the Internet using set-top boxes. One such service is WebTV which enables a user to browse the Web using a TV as the display. WebTV, however, duplicates much of the hardware and software included in a standard PC. For example, WebTV includes a modem while many PCs come equipped with one. Consequently, the consumer who already owns a PC may pay the cost of the modem twice: once when buying the PC and a second time when buying WebTV. Furthermore, WebTV may also duplicate a portion of the functions found in most TVs.

This duplication of PC and TV components may make WebTV unnecessarily expensive or complex to the many consumers who already own a PC.

As the popularity of TV and services increase, it may become more desirable to provide multiple users in the same household with the capability to use services separately. Unfortunately, the cost to provide multiple TV users separate access to the services described above may be prohibitive. For example, viewers of different TVs may desire separate information.

Furthermore, as the popularity of cable television services increases, new consumer devices may become available for home use. For example, new types of consumer devices such as cable ready televisions, cable tuners, and video cassette recorders may be connected to cabling which carries the transmission of the cable television services for use by consumers in their homes. As the number of consumer devices used in the home increases, the cabling needed inside the home may also increase and become unwieldy. As a result, the cabling may be integrated into the structure of the home, for example in the walls and floors. It is known to use coaxial cable having an impedance of 75 ohms in some cable systems for the transmission of the cable television services.

The cabling may conduct television signals and other signals which include the cable television services, and Direct Current (DC) voltages or Alternating Current (AC) voltages for controlling the consumer devices. For example, a television signal and a DC voltage may be transmitted over the cabling to provide a video signal and a DC voltage for controlling a cable tuner.

Personal Computers also may be capable of communicating with other devices, such as the consumer devices described above. Unfortunately, separate wiring may be needed to provide the communications between the devices. For example, a serial data cable may be needed to connect two PCs. Unfortunately, if the PCs are located in different areas of the home, the serial data cable may need to be long which may make the serial data cable expensive and unwieldy. Therefore, a need exists to further improve methods and systems for providing services via consumer devices and PCs.

Summary of the Invention

It is an object of the present invention to provide improved set-top boxes for use with television services.

It is another object of the present invention to provide improved systems for the use of multiple set-top boxes.

It is, therefore, an object of the present invention to allow an improvement in the transfer of data between devices within a building.

It is another object of the present invention to allow improvement in transferring data over transmission lines which conduct television signals.

These and other objects of the present invention may be provided by set-top boxes, identified by respective identifiers (IDs), that send requests for information to a PC over a television signal transmission line. The request can include the ID of the set-top box that made the request. When the requested information is accessed, the requested information and the ID of the set-top box that made the request can be transmitted over the communications link to the set-top box using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal on the television signal transmission line. Accordingly, multiple set-top boxes may access information from a single residence via an existing PC, thereby allowing a more cost-effective approach than conventional systems.

In one embodiment, a computer program running on the PC can handle requests from the plurality of set-top boxes. In another embodiment, a computer program can be instantiated for each of the plurality of set-top boxes. For example, a first computer program can be instantiated to handle requests from the first set-top box and a second computer program can be instantiated to handle requests from the second set-top box.

The frequency shift keying modulation can be provided by generating a modulated data signal based on information included in the data. For example, the frequency shift keying modulation can generate a modulated data signal at a first frequency when the data is equal to a logical 0 and at a second frequency when the data is equal to a logical 1. In one embodiment, the first frequency is about 800KHz and the second frequency is about 1MHz.

Frequency shift keying modulation may provide a reduction in the cost of transferring data. In particular, the frequency shift keying modulation may be embodied using relatively few components. In contrast, some conventional data transfers are performed using phase shift keying modulation which may be more expensive than a system according to the present invention.

Brief Description of the Drawings

FIG. 1 is a block diagram of a first embodiment of systems and methods according to the present invention.

FIG. 2 is an exemplary display of information provided to a user on a TV.

FIG. 3 is a block diagram of a second embodiment of systems and methods according to the present invention.

FIG. 4 is a block diagram of an embodiment of a set-top box according to the present invention.

FIG. 5 is a block diagram of an embodiment of a PC according to the present invention.

FIG. 6 is an embodiment of a packet structure according to the present invention.

FIG. 7 is a flowchart that illustrates initialization operations of a set-top box according to the present invention.

FIG. 8 is a flowchart that illustrates initialization operations of a computer program running on the PC in coordination with the operations illustrated in **FIG. 7**.

FIG. 9 is a flowchart that illustrates operations of a set-top box in response to requests for information.

FIG. 10 is a flowchart that illustrates operations of the computer program running on the PC in response to incoming requests for information from set-top boxes.

FIG. 11 is a flowchart that illustrates operations of a set-top box in response to information broadcast by the PC.

FIG. 12 is a block diagram of a cable transfer interface according to the present invention.

FIG. 13 is a schematic diagram of an exemplary embodiment of a cable transfer interface according to the present invention.

Detailed Description of the Invention

The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which a preferred embodiment of the invention is shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

The phrase "television signal" as used herein includes signals formatted for display on television sets such as National Television System Committee (NTSC) format video provided in some conventional cable television systems. NTSC formatted video includes 525 lines at a horizontal frequency of 15.734 KHz and a vertical frequency of 60 Hz. Other signals formatted for display on television also are included. As described herein the phrase "transmit operation" refers to the transmission of data from a PC to a set-top box over a transmission line. Similarly, the phrase "receive operation" refers to the transmission of data from the set-top box to the PC. Like numbers refer to like elements throughout.

As will be appreciated by one of skill in the art, the present invention may be embodied as a method, data processing system and/or program product. Accordingly, the present invention may take the form of an entirely hardware embodiment, an entirely software embodiment or an embodiment combining software and hardware aspects. Furthermore, the present invention may take the form of a computer program product on a computer-readable storage medium having computer-readable program code means embodied in the medium. Any suitable computer readable medium may be utilized including hard disks, CD-ROMs, optical storage devices, or magnetic storage devices.

The present invention is also described using block diagrams and flowcharts. Those skilled in the art will understand that the blocks in the block diagrams and the flowchart illustrations, and combinations of blocks, may be implemented with various commonly used components. It will also be understood that portions of the operations described in the blocks may be executed as computer program instructions loaded into a computer or other data processing apparatus, thus producing a machine which provides means for implementing the functions specified in the flowchart blocks and combinations

thereof. The computer program may cause operational steps to be performed on the computer or data processing apparatus to produce a computer-implemented process such that the instructions which execute on the computer or data processing apparatus provide steps for implementing the functions of the blocks or combinations thereof. Accordingly, the blocks support combinations of means for performing the specified functions and combinations of steps for performing the specified functions.

FIG. 1 is a block diagram that illustrates systems and methods according to a first embodiment of the present invention. According to the embodiment of **FIG. 1**, the system can include a plurality of set-top boxes **100a-b**, each of which accepts requests from respective remote controls **105a-b**. According to **FIG. 1**, a user pushes buttons on the remote control **105a** to request the display of information on a TV **102a**. The remote control **105a** transmits a corresponding command to the set-top box **100a** associated with the remote control. It will be understood that functions of the remote control alternately can be provided directly on the set-top box and/or the remote control can be coupled to the set-top box via means such as a cable, RF coupling and/or IR coupling. The set-top box **100a** can send a request for the information to a Personal Computer (PC) **135** over a communications link **130**. Each set-top box **100a-b** can request different information from the PC **135**, which responds by accessing the requested information locally or via a network **103**, such as the Internet. As used herein, the term "information" includes information such as television program information (such as that shown in **FIG. 2**), e-mail, chat, sports scores, weather and the like. Set-top boxes are discussed in U.S. Patent Application No. 09/005269 entitled *Methods and Systems for Providing Television Related Services via a Networked Personal Computer"* which is commonly assigned to the assignee of the present application and which is incorporated herein by reference.

Each request for information by a set-top box **100a-b** can include an Identifier (ID) that identifies the set-top box **100a-b** which made the request. For example, the first set-top box **100a** can be identified by a first ID of FF_{16} and the second set-top box **100b** can be identified by a second ID of $F0_{16}$. Requests sent to the PC **135** by the first set-top box **100a** include the first ID FF_{16} and requests sent to the PC **135** by the second set-top box **100b** include the second ID $F0_{16}$. The PC **135** can use the respective IDs of the first

and second set-top boxes **100a-b** to associate each received request with the set-top box that sent the request.

The PC **135** can access the requested information and can broadcast the requested information and the ID of the set-top box **100a-b** that made the request over the communications link **130**. For example, the PC **135** can broadcast information requested by the first set-top box **100a** with the first ID FF_{16} and can broadcast information requested by the second set-top box **100b** with the second ID $F0_{16}$ over the communications link **130**.

Each set-top box **100a-b** can receive the information and the associated ID broadcast by the PC **135**. Each set-top box **100a-b** can compare the ID included with the information broadcast by the PC **135** to the ID stored in the set-top box **100a-b**. For example, when the PC **135** broadcasts the information requested by the first set-top box **100a**, the PC **135** includes the first ID. Accordingly, the first set-top box **100a** compares the ID associated with the first information broadcast by the PC **135** to the ID associated with the first set-top box **100a**. When a match occurs, the first set-top box **100a** accepts the information and provides it to the TV **102a**. Moreover, the second set-top box **100b** compares the ID associated with the first information broadcast by the PC **135** to the ID associated with the second set-top box **100b**. When a mismatch occurs, the second set-top box **100b** does not accept the information.

The communications link **130** can be any communications medium known to those having skill in the art. In one embodiment, the communications link **130** can be a cable **117** such as those used to provide cable service to residential customers. Each set-top box **100a-b** and the PC **135** can be electrically coupled to the cable **117** via respective Cable Transfer Interfaces (CTI) **110a-c**. In particular, each set-top box **100a-b** can send requests for information over the cable **117** through the associated CTI **110a-b**. The PC **135** can receive the requests and can broadcast requested information through the associated CTI **110c**. The cable **117** couples the CTIs **110a-c** to one another through cable splitters **115 a-d**. The cable splitters **115a-d** can be used to distribute an input signal to multiple outputs while maintaining the proper termination for the cable **117**. Direct Current (DC) blocking circuits **120a-e** can be used to filter DC voltage levels

provided by some cable systems and fed back by some TVs and set-top boxes on the cable **117**.

The set-top box **100a** can request information by sending requests to the PC **135** and can receive the corresponding information from the PC **135** over the communications link **130** according to a command protocol described herein. User commands received from the remote control **105a** are processed by the set-top box **100a** to determine what action is necessary to display the desired information. If the requested information is not available within set-top box **100a**, the set-top box **100a** can send a request for the information to the PC **135**. In response, the information requested by the set-top box **100a** can be broadcast over the communications link **130** by the PC **135** and can be received by the appropriate set-top box **100a** which formats the information for display on the TV **102a**.

A request can include computer commands organized to access the information requested by the user via the remote control **105a**. For example, the request may comprise a list of instructions which cause the PC **135** to access the network **130** and issue some of the commands included in the request to the network **130**. In one embodiment, the access to the network can be provided using a telephone line. In the alternate embodiment of **FIG. 3**, access to the network can be provided by the cable system via a cable modem **301**.

As shown in **FIG. 4**, the set-top box **100a** can include a central processing unit (CPU) or controller **421**, a Random Access Memory (RAM) **422**, a Read Only Memory (ROM) **423**, a Video Processing system (VP) **418**, a Video Buffer (VRAM) **419**, a TV interface **411**, a Communication Link Interface (CLI) **417**, and a wireless infra-red (IR) sensor **414**. In one embodiment, the ID of the set-top box **100a** can be stored in the ROM **423**. In another embodiment, the ID can be encoded by switches **450**, the settings of which can be read by the CPU **421**. The above components are well known to those having skill in the art and need not be described further herein.

The CPU **421** may be suitable for running a computer program to process information from the PC **135**, processes user commands from the remote control **105a**, control the formatting of information for display on the TV **102a**, and provide general system services to the set-top box **100a**. The CPU **421** may process user commands

received from the remote control **105a** as a stream of serial data. For example, if the user pushes a button on the remote control **105a** that corresponds to a command requiring information from the network **103**, the CPU **421** receives the command in an internal serial buffer from the IR sensor **415**. The CPU **421** sends a corresponding computer command to the CLI **417** and the command is transmitted over communications link to the PC **135** via the CTI **110a** and the network **103**. The CPU **421** may also process information from the PC **135**. For example, when information is returned from the network **130**, it is received by the CLI **417**. The CPU **421** accepts the information from the CLI **417** as a stream of serial data. In one embodiment, the CPU **421** may process the data received from the remote control **105a** and information from the PC **135** and the network **103** as a single serial data stream.

The VP **418** may be used by the CPU **421** to combine information from the PC **135** with a TV signal **455** for display on the TV **102a** or select between the two for display. The data from the VP **418** may be represented in RGB format wherein a first portion of the data represents red information, a second portion represents green information, and a third portion represents blue information. The VP **418** may be implemented with a YVG606 Video Processor manufactured by Yamaha Inc.

The wireless IR sensor **414** receives user commands from the remote control **105a**. The wireless IR sensor **414** provides the user commands from the remote control **105a** to the CPU **421** for processing. The user commands can be processed by the CPU **421** as a serial data stream.

The PC **135** examines the request from the set-top box **100a** to determine which set-top box **100a-b** is requesting the information. In one embodiment, a computer program running on the PC **135** handles the requests from the set-top boxes **100a-b** in an integrated fashion. For example, the computer program can record each request and the ID of the set-top box **100a-b** which made the request in a table or using other techniques known to those having skill in the art. The computer program may cause the PC **135** to access the requested information and broadcast the requested information and the ID associated with the request over the cable **117**. For example, if the computer program determines that the requested information should be accessed via the Internet, the computer program causes the PC **135** to access and request the information from the

Internet. When the requested information is provided to the computer program from the Internet, the computer program looks up the request in the table to determine which set-top box **100a-b** requested the information and broadcasts the requested information and the associated ID on the cable **117**.

Requests from the set-top box **100a-b** are handled in view of the context in which the requests are made. For example, if the first set-top box **100a** is presently displaying an e-mail session, subsequent requests are handled in the context of an e-mail session. In particular, the screen being currently displayed by the set-top box **100a** and the keyboard input can be included in the context of the requests.

The computer program can combine requests from multiple set-top boxes **100a-b** to the network. For example, if a first set-top box **100a** sends a first request for first information and a second set-top box **100b** sends a second request for second information, the computer program combines the two requests into a single request to the network **130** using techniques known to those having skill in the art.

In another embodiment of the present invention, the PC **135** instantiates a plurality of computer programs, wherein each of the plurality of computer programs instantiated is associated with one of the set-top boxes **100a**. In this embodiment, an interface program running on the PC **130** interfaces the plurality of computer programs to the network **130**. For example, in a situation where the first and second set-top boxes **100a-b** are being used, respective first and second computer programs are instantiated to handle requests from the set-top boxes **100a-b**. Accordingly, when the first and second set-top boxes **100a-b** request information from the network **130**, the interface program coordinates access to the network **103**.

According to **FIG. 5**, the PC **135** can be a computer capable of running a wide range of applications software and may include a CPU **542**, a memory **541**, a network interface **543**, a hard disk drive **540**, an interface **531**, a keyboard **539**, a monitor **538** and other hardware and software components commonly found in personal computers. For example, the PC **135** may be implemented using a Pentium microprocessor marketed by Intel running the Windows 98 Operating System marketed by Microsoft Inc. The PC **135** processes the requests for information received from the set-top boxes **100a-b** over the cable **117** via the CTI **110c**, and accesses the requested information which is broadcast

over the cable **117** through the CTI **110c**. In addition, other processing systems such as workstations, mainframes, mini computers, and/or custom systems can be used.

Requests by the set-top boxes **100a-b** and information broadcast by the PC **135** can be structured in a packet format as illustrated in **FIG. 6**. Accordingly, requests for the set-top boxes **100a-b** can be referred to as request packets, and requested information broadcast by the PC **135** can be referred to as information packets. The packet format of **FIG. 6** can include a START byte, an ID word, an INSTR byte, a LENGTH word, a number of DATA bytes, a CKSUM word, and a STOP byte. The Start byte can signal the start of the packet. In a particular embodiment, the START byte can be the value FF_{16}. The ID word corresponds to the ID associated with the set-to box **100a-b**. In one embodiment, the ID word can be the least significant word of the serial number of the set-top box.

The INSTR byte can be an instruction or command to be executed by the set-top box **100a**. The LENGTH word can be the number of bytes contained in the DATA field. The DATA can be a number of data bytes associated with the INSTR field. For example, if a particular command or instruction has associated data or parameters, the data is stored in the DATA field. The number of data bytes included in the DATA field is described by the LENGTH field. The CKSUM can be the least significant word of the sum of each byte contained in the INSTR, LENGTH, and DATA fields. The STOP byte can signal the end of the packet. In a particular embodiment, the STOP byte is the value FF_{16}.

FIG. 7 is a flowchart that illustrates initialization operations of the set-top box according to the present invention. When the user powers the set-top box up (block **700**) a self test can be performed (block **705**). The ID of the set-top box can be determined and a power-up packet can be sent to the PC (block **715**). The power-up packet can signal the PC that the set-top box has been turned on and may provide requests for information. The set-top box can wait for an acknowledgement packet from the PC (block **720**). The acknowledgement packet can signal the set-top box that the power-up packet was recognized by the PC.

When the acknowledgement packet is received from the PC (block **725**), the set-top box begins processing requests from the user for information to be displayed and begins processing information packets broadcast by the PC (block **730**).

FIG. 8 is a flowchart that illustrates initialization operations of a computer program running on the PC **135** in coordination with the initialization operations illustrated in **FIG. 7**. The computer program begins processing incoming requests from the set-top boxes in block **800**. A determination is made as to whether an incoming packet is a power-up packet from a set-top box (block **805**). If the incoming packet is not a power-up packet, the packet is processed as a request packet from a known set-top box as shown in **FIG. 9** (block **810**).

If the packet is a power-up packet, the ID associated with the power-up packet is determined (block **815**) and the ID is compared to the IDs of all known set-top boxes (block **820**). If the ID included in the power-up packet is the same as an ID associated with a known set-top box, operations continue with the processing of incoming request packet (block **810**). If the ID included in the power-up packet is not known, the ID is recorded as an ID associated with a known set-top box and a computer program according to the present invention is instantiated (block **825**). In particular, request packet from the set-top box associated with the ID included in the power-up packet above are handled by the instantiated computer program. Accordingly, a computer program may be instantiated for each known set-top box. A power-up acknowledgement packet is broadcast on the communications link (block **830**) and the operations continue, wherein a determination is made as to whether an incoming packet is a power-up packet from a set-top box (block **805**).

FIG. 9 is a flowchart that illustrates operations of a set-top box in response to requests for information. According to **FIG. 9**, the set-top box begins processing input at block **900**. The set-top box waits for a command from the remote control (block **910**). When a remote control command is detected (block **910**), the set-top box determines if the requested information is resident in the set-top box (block **915**). If the information is resident in the set-top box, the set-top box sends the requested information to the TV (block **925**). If, however, the requested information is not resident in the set-top box, the

set-top box sends a request for the information, including the ID of the set-top box, to the PC (block **920**).

FIG. 10 is a flowchart that illustrates operations of a computer program running on the PC in response to incoming request packets for information from the set-top boxes. According to **FIG. 10**, processing begins at block **1000**. An incoming request for information is decoded (block **1010**) and the ID included in the request is determined (block **1020**). If the ID included in the request is not associated with a known set-top box (block **1030**), the request is not accepted and processing continues at block **1010**.

If, however, the ID included in the request is associated with a known set-top box (block **1030**), the request is accepted and provided to the computer program instantiated to handle requests from the set-top box associated with the ID included with the request (block **1040**). When the requested information is received (block **1050**), the requested information is broadcast over the communications link (block **1060**) and processing continues at block **1010**.

FIG. 11 is a flowchart that illustrates operations of a set-top box in response to information broadcast by the PC. According to **FIG. 11**, the processing of incoming packets from the PC begins in block **1100**. When a packet is received from the PC (block **1110**), the ID included in the packet is compared to the ID of the set-top box (block **1120**).

If the ID included in the packet is not equal to the ID of the set-top box (block **1130**), the packet is not accepted by the set-top box. The set-top box waits for another incoming packet from the PC (block **1110**). If the ID included in the packet is equal to the ID of the set-top box (block **1130**), the packet is accepted and the requested information is provided to the TV (block **1140**) and processing continues at block **1010**.

An embodiment of the cable transfer interface **110a** will now be described in greater detail. According to **FIG. 1**, data is transferred between the PC **135** and the set-top box **100a** over the transmission line **130**, such as a coaxial cable, used to conduct a television signal. The set-top box **100a** controls the display of a television **102** in response to commands issued by a user to the set-top box **100a**. Some commands may cause the set-top box **100a** to request information, such as broadcast times, from the PC

135. In response, the PC **135** may retrieve the information from the network **103** and transmit the information to the set-top box **100a**.

Although the embodiment of **FIG. 1** shows the PC **135** connected to the set-top box **100** via the transmission line **130**, it will be understood that other devices may be used. For example, in another embodiment, two PCs may be connected via the transmission line **130** to allow the transfer of serial data between the PCs. In still another embodiment, the cable transfer interface can be powered by a separate DC power supply.

Data is transferred between the PC **135** and the set-top box **100a** in a half-duplex fashion that may be controlled by a computer program running on one or more processors. For example, the PC **135** and the set-top box **100a** may each include one or more processors that run computer programs to coordinate the transfer of data over the transmission line **130**. In operation, a transmission by either the PC **135** or the set-top box **100a** may stop to allow the other device to transmit. The half-duplex control of the PC **135** and the set-top box **100a** can be performed according to techniques known to those having skill in the art. The transmission line **130** includes the splitters **115 a-d** that distribute the television signal **127** to the plurality of devices via cables **117** as shown in **FIG. 1**. The transmission line **130** can include conventional cabling such as that installed in the walls and floors of houses.

For simplicity, the transmit operation is described first, wherein data is transmitted from the set-top box **100a** to the PC **135** such as when the user requests programming information to be displayed. Second, a receive operation is described in which data is transmitted from the PC **135** to the set-top box **100a** such as when the PC **135** responds to the request by transferring the program information to the set-top box **100a**.

In the transmit operation, the set-top box **100** can transmit data to the first cable transfer interface (CTI) **110a** using an interface format such as an RS-232 serial interface standard, although other interface formats may be used as well. In one embodiment, a 9-pin serial data port on the set-top box **100** can be used to transmit and receive the data.

The first cable transfer interface **110a** can process the data received from the set-top box **100** using frequency shift keying modulation to provide a modulated data signal which is transmitted over the transmission line **130** which also conducts the television

signal **127**. However, the modulated data signal occupies a frequency range that is not within the television signal frequency range used to conduct the television signal.

The data transmitted by the first cable transfer interface **110a** is transferred to the PC **135** through splitters **115a, c, d**. The splitter **115d** distributes the television signal **127** to the televisions **102a-c**, the first and second cable transfer interfaces **110a, c** and the set-top boxes **100a-b** via the cable **117**. Consequently, the cable **117** conducts a distributed version of the television signal **127** and the data transmitted by the first cable transfer interface **110a**. Other devices, such as videocassette recorders or other devices known in the art may be used in place of the televisions **102**.

A second cable transfer interface **110c** can process the data transmitted by the first cable transfer interface **110a** to provide data to the PC **135** according to the interface format described above. In one embodiment, a 9-pin serial data port on the PC **135** can be used to transmit and receive data between the PC **135** and the second cable transfer interface **110c**.

In the receive operation, data can be transmitted from the PC **135** to the set-top box **100a**, such as when the PC **135** responds to the request transmitted by the set-top box **100a**. In particular, data can be transmitted from the PC **135** to the second cable transfer interface **110c** according to the interface format described above. The second cable transfer interface **110c** can process the data to provide a second modulated data signal that is transmitted over the transmission line **130** to the first cable transfer interface **110a**. The first cable transfer interface **110a** demodulates the data received from the PC **135** and provides data to the set-top box **100a** according to the interface format. The set-top box **100a** uses the data to control the display of a distributed version of the television signal **127** on the television **102a** provided to the set-top box **100a**. In another embodiment, the same cable can be used to provide the distributed version of the television signal **127** and the data to the first cable transfer interface **110a** and the set-top box **100a**.

Accordingly, cabling installed in houses can be used to transfer data between devices, such as PCs and set-top boxes. For example, existing cabling can be used to connect a PC with a set-top box, thereby allowing data to be transferred between the set-top box and the PC. Moreover, the data transfer does not interfere with the television signal conducted over the same cable. The cabling can be installed in the floors and

walls of the house, thereby making the connection between the devices less cumbersome and less expensive than adding a dedicated cable between the devices.

FIG. 12 is a block diagram of a cable transfer interface **110** according to the present invention. In a transmit operation the data formatted according to the interface format can be received by a converter **200** which converts the received data to Complementary Metal Oxide Semiconductor (CMOS) or Transistor to Transistor Logic (TTL) voltage levels (such as 0-5 volts) to provide a transmit format data signal. A transmitter **205** can process the transmit format data signal using Frequency Shift Keying (FSK) modulation to provide the transmit modulated data signal. The FSK modulation can be performed using a frequency range that is not within a television signal frequency range used to conduct the television signal **127** over the transmission line **130**. For example, in one embodiment the FSK modulation is performed using frequencies in a range between about 800KHz and 1MHz.

The transmit modulated data signal can be provided to a switch **210** that electrically couples the transmit modulated data signal to the transmission line **130** under the control of the data provided to the cable transfer interface **110**. For example, a Ready To Send (RTS) signal included in an RS-232 interface can be used to control the switch direction to electrically couple the transmit modulated data signal to the transmission line **130**.

The transmitter **205** can include an FSK modulator **220** that provides a modulated data signal using a frequency range that is not within the television signal frequency range used to conduct the television signal **127** over the transmission line **130**. The FSK modulator **220** generates the modulated data signal at a frequency based on information included in the transmit format data signal. For example, in one embodiment the FSK modulator **220** generates the modulated data signal at a frequency of 800KHz upon detecting that the transmit format data signal is equal to a logical 0. When the transmit format data signal transitions to a logical 1, the FSK modulator **220** generates the modulated data signal at a frequency of 1MHz.

The modulated data signal is provided to a transmit interface **225** that provides the transmit modulated data signal to the switch **210**. In particular, the transmit interface **225** drives the transmit modulated data signal over the transmission line **130** via the switch

210 to compensate for a variety of transmission line 130 configurations. For example, the transmit interface 225 may drive the transmit modulated data signal over a 200-foot transmission line 130 with an impedance in a range between about 25 ohms and 75 ohms.

In a receive operation data is transferred over the transmission line 130 to the switch 210 which electrically couples the data from the transmission line 130 to receiver 215 under the control of the data provided to the cable transfer interface 110 to provide a receive modulated data signal. For example, a Ready To Send (RTS) signal included in an RS-232 interface can be used to control the switch direction to electrically couple the data from the transmission line 130 to the receiver 215.

The receiver 215 processes the receive modulated data signal to provide a demodulated data signal to the converter 200. In particular, the receiver 215 processes the receive modulated data signal using FSK demodulation over a frequency range that is not within a television signal frequency range used to conduct the television signal 127 over the transmission line 130 to provide a receive format data signal.

The converter 200 converts the receive format data signal to the interface format as described above. For example, in one embodiment the receive format data signal can be converted from CMOS voltage levels to RS-232 voltage levels.

The receiver 205 can include a receive interface 230 that matches the impedance of the cable transfer interface 110 to the transmission line 130 to provide a receive modulated data signal. For example, in one embodiment, the receive interface 230 can provide a 75 ohm termination for the transmission line 130. The receiver 205 also includes an FSK demodulator 235 that provides a demodulated data signal using a frequency range that is not within the television signal frequency range used to conduct the television signal 127 over the transmission line 130 to provide the demodulator data signal. For example, in one embodiment the FSK demodulator 235 generates a logical 0 upon demodulating the modulated data signal at a frequency of 800KHz. The FSK demodulator 235 generates a logical 1 upon demodulating the modulation data signal at a frequency of 1Mhz.

FIG. 13 is a schematic diagram of an exemplary embodiment of a cable transfer interface 110 according to the present invention. According to **FIG. 13**, data can be transmitted to/from the cable transfer interface 110 via connector 300. The data is

converted to/from CMOS voltage levels from/to RS-232 voltage levels by an interface format chip **305** such as a MAX232CWE marketed by Maxim, Inc. The CMOS level data is processed by the FSK modulator **310** to provide a transmit modulated data signal. The FSK modulator **310** may be a Monolithic PLL XR0215ACD marketed by Exar, Inc.

The transmit modulated data signal is driven over the transmission line **130** by the transmit interface **225**. The transmit interface **225** can include a transistor **Q1** and resistors **R14** and **R15** in an emitter follower configuration. The emitter follower configuration can allow the transmit interface to drive the transmit modulated data signal over the transmission line **130** up to 200 feet at an impedance in the range of about 25 ohms to 75 ohms.

The transmit modulated data signal can be provided to a switch **320** which couples the transmit modulated data signal to the transmission line **130** during a transmit operation. The switch **320** may be an analog switch PI5A383AW marketed by Pericom, Inc. The switch **320** also can couple data from the transmission line **130** to FSK demodulator **325** via the receive interface **230** during a receive operation to provide the receive modulated data signal. The direction of the switch **320** is controlled by an RTS signal generated at pin 9 of the interface format chip **305**. For example, the RTS signal indicates that a device is ready to send data. Accordingly, the direction of the switch **320** is set to receive data from the device sending the RTS signal.

The FSK demodulator **325** can demodulate the receive modulated data signal to provide a demodulated data signal. The FSK demodulator **325** may be a Monolithic PLL XR0215ACD marketed by Exar, Inc. The demodulated data signal may have an amplitude of about 200mV.

The demodulated data signal can be compared to a reference voltage (controlled by potentiometer R32) by the comparator **330**. The comparator **330** shifts the voltage level of the demodulated data signal to CMOS voltage levels to provide the receive format data signal. The comparator **330** may be a Voltage Comparator LM311M marketed by National Semiconductor, Inc. The receive format data signal is provided to the interface format chip **305** for conversion to RS-232 voltage levels upon which data is transmitted over the connector **300**.

Accordingly, cabling installed in houses can be used to transfer data between devices, such as PCs and set-top boxes. For example, existing cabling can be used to connect a PC with a set-top box, thereby allowing data to be transferred between the set-top box and the PC. Moreover, the data transfer does not interfere with the television signal conducted over the same cable. The cabling can be installed in the floors and walls of the house, thereby making the connection between the devices less cumbersome and less expensive than adding a dedicated cable between the devices.

In addition, set-top boxes can be identified by respective IDs. The set-top boxes can send requests for information over a communications link to a PC. The requests can include the ID of the set-top box that made the request. When the requested information is accessed by the PC, the requested information and the ID of the set-top box that made the request are transmitted over the communications link to the set-top box. Accordingly, multiple set-top boxes may access information from a single residence via an existing PC, thereby allowing a more cost-effective approach than conventional systems.

In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims.

What is Claimed is:

1. A method of providing information from a personal computer to a set-top box over a television signal transmission line, the method comprising the steps of:

receiving a request for information from the set-top box at the personal computer, wherein the request includes an ID that identifies the set-top box;

accessing the requested information by the personal computer; and

transmitting the requested information and the ID that identifies the set-top box from the personal computer to the set-top box over the television signal transmission line using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the television signal transmission line.

2. The method of Claim 1 further comprising the steps of:

receiving a second request for second information from a second set-top box at the personal computer, wherein the second request includes a second ID that identifies the second set-top box;

accessing the second requested information by the personal computer; and

transmitting the second requested information and a second ID that identifies the second set-top box from the personal computer to the set-top box over the television signal transmission line using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the television signal transmission line.

3. The method of Claim 1, wherein the step of transmitting comprises the step of transmitting data from a first device to a second device over the television signal transmission line which simultaneously conducts a television signal.

4. The method of Claim 2, wherein the step of accessing comprises the steps of:

accessing the first requested information based on a first context associated with the first set-top box; and

accessing the second requested information based on a second context associated with the second set-top box.

5. The method of Claim 3, wherein the step of transmitting comprises the steps of:

generating a modulated data signal at a frequency that is based on the data; and

transmitting the modulated data signal from the first device to the second device over the television signal transmission line.

6. The method of Claim 2, wherein the step of accessing comprises the steps of:

combining the first request for information and the second request for information at the personal computer; and

accessing the first requested information and the second requested information by the personal computer via a network.

7. The method of Claim 4, wherein the step of accessing comprises the step of accessing the first requested information by the personal computer based on a first keyboard status and a first screen status.

8. The method of Claim 1, wherein the step of transmitting comprises the step of broadcasting a plurality of information packets by the personal computer over the television signal transmission line using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the television signal transmission line.

9. The method of Claim 1, wherein the step of accessing comprises the step of accessing the requested information by the personal computer via a network.

10. The method of Claim 1 further comprising the steps of:

sending a power-up packet including the ID of the set-top box from the set-top box to the personal computer over the communications link from the set-top box;

recording the ID of the set-top box included in the power-up packet at the personal computer to designate the set-top box as known; and

transmitting an acknowledgement packet including the ID of the set-top box from the personal computer over the communications link to the set-top box to acknowledge receipt of the power-up packet from the set-top box.

11. A method of providing information to a set-top box over a communications link, the method comprising the steps of:

receiving a request for information from the set-top box, wherein the request includes an ID that identifies the set-top box;

accessing the requested information; and

transmitting the requested information and the ID that identifies the set-top box over the communications link.

12. The method of Claim 11 further comprising the steps of:

receiving a second request for second information from a second set-top box, wherein the second request includes a second ID that identifies the second set-top box;

accessing the second requested information; and

transmitting the second requested information and a second ID that identifies the second set-top box over the communications link.

13. A method of providing information from a personal computer to a set-top box over a communications link, the method comprising the steps of:

receiving a request for information from the set-top box at the personal computer, wherein the request includes an ID that identifies the set-top box;

accessing the requested information by the personal computer; and

transmitting the requested information and the ID that identifies the set-top box from the personal computer to the set-top box over the communications link.

14. The method of Claim 13 further comprising the steps of:

receiving a second request for second information from a second set-top box at the personal computer, wherein the second request includes a second ID that identifies the second set-top box;

accessing the second requested information by the personal computer; and

transmitting the second requested information and a second ID that identifies the second set-top box from the personal computer to the set-top box over the communications link.

15. The method of Claim 14, wherein the step of accessing comprises the steps of:

accessing the first requested information based on a first context associated with the first set-top box; and

accessing the second requested information based on a second context associated with the second set-top box.

16. The method of Claim 14, wherein the step of accessing comprises the steps of:

combining the first request for information and the second request for information at the personal computer; and

accessing the first requested information and the second requested information by the personal computer via a network.

17. The method of Claim 15, wherein the step of accessing comprises the step of accessing the first requested information by the personal computer based on a first keyboard status and a first screen status.

18. The method of Claim 13, wherein the step of transmitting comprises the step of broadcasting a plurality of information packets by the personal computer over the

communications link, wherein at least one of the information packets includes the ID that identifies the set-top box that requested the information.

19. The method of Claim 13, wherein the step of accessing comprises the step of accessing the requested information by the personal computer via a network.

20. The method of Claim 13 further comprising the steps of:

sending a power-up packet including the ID of the set-top box from the set-top box to the personal computer over the communications link from the set-top box;

recording the ID of the set-top box included in the power-up packet at the personal computer to designate the set-top box as known; and

transmitting an acknowledgement packet including the ID of the set-top box from the personal computer over the communications link to the set-top box to acknowledge receipt of the power-up packet from the set-top box.

21. A set-top box that interfaces to a television and requests information from a personal computer over a communications link, wherein the set-top box is identified by an associated set-top box ID, wherein the set-top box transmits requests for information and the set-top box ID to the personal computer and receives the information and an associated ID from the PC over the communications link.

22. The set-top box of Claim 21, wherein the set-top box accepts the information from the personal computer if the received associated ID identifies the set-top box.

23. The set-top box of Claim 22, wherein the set-top box rejects the information transmitted by the personal computer if the received associated ID does not identify the set-top box.

24. The set-top box of Claim 21, wherein the communications link is a coaxial cable.

25. The set-top box of Claim 21, wherein the set-top box is configured to be coupled to the personal computer in a house.

26. A system that provides information over a communications link, the system comprising:

a set-top box, configured to be coupled to a television, wherein the set-top box transmits requests for information intended for display on the television, wherein the set-top box has an associated ID that identifies the set-top box; and

a personal computer, configured to be coupled to a network and to the set-top box via the communications link, wherein the personal computer receives the requests for information from the set-top box, accesses the requested information and transmits the requested information and the ID associated with the set-top box to the set-top box.

27. The system of Claim 26, wherein the personal computer receives second requests for information from a second set-top box, wherein the second requests include a second associated ID that identifies the second set-top box, and wherein the personal computer accesses the second requested information and transmits the second requested information and the second ID associated with the second set-top box to the second set-top box.

28. The system of Claim 27, wherein the personal computer accesses the first requested information based on a first context associated with the first set-top box and accesses the second requested information based on a second context associated with the second set-top box.

29. The system of Claim 27, wherein personal computer combines the first request for information and the second request for information and accesses the first requested information and the second requested information via a network.

30. The system of Claim 28, wherein the personal computer accesses the first requested information based on a first keyboard status and a first screen status.

31. The system of Claim 26, wherein the personal computer broadcasts a plurality of information packets over the communication link, wherein at least one of the information packets includes the ID that identifies the set-top box that requested the information.

32. The system of Claim 26, wherein the personal computer accesses the requested information via a network if the personal computer determines that the requested information is not stored on the personal computer.

33. A method of transferring data over a television signal transmission line comprising the step of:

transferring the data using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the television signal transmission line.

34. The method of Claim 33, wherein the step of transferring comprises the step of transmitting the data from a first device to a second device over the television signal transmission line which simultaneously conducts a television signal.

35. The method of Claim 33, wherein the step of transferring comprises the step of receiving the data from the television signal transmission line which simultaneously conducts a television signal.

36. The method of Claim 34, wherein the step of transmitting comprises the steps of:

generating a modulated data signal at a frequency that is based on information included in the data; and

transmitting the modulated data signal from the first device to the second device over the television signal transmission line.

37. The method of Claim 34, wherein the step of transmitting comprises the steps of:

converting an interface format data signal to an internal format data signal;

generating a modulated data signal at a frequency based on information included in the internal format data signal;

driving the modulated data signal to compensate for a characteristic impedance of the television signal transmission line to provide a buffered modulated data signal; and

setting a switch direction that electrically couples the buffered modulated data signal to the television signal transmission line.

38. The method of Claim 35, wherein the step of receiving comprises the steps of:

setting a switch direction that electrically couples the data from the television signal transmission line to provide a buffered modulated data signal;

receiving the buffered modulated data signal to compensate for a characteristic impedance of the television signal transmission line;

generating an internal format data signal from the buffered modulated data signal using frequency shift keying demodulation based on a frequency of the buffered modulated data signal; and

converting the internal format data signal to an interface format data signal.

39. The method of Claim 33, wherein the step of transferring comprises the step of transferring the data from a first device in a residence to a second device in the residence.

40. The method of Claim 33, wherein the step of transferring comprises the step of transferring data over a coaxial cable.

41. A method of communicating in a residence via cable installed in the house, the method comprising the step of:

transferring data over the installed cable using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over a television signal transmission line.

42. The method of Claim 41, wherein the step of transferring comprises the step of transmitting the data from a first device to a second device over the installed cable which simultaneously conducts a television signal.

43. The method of Claim 41, wherein the step of transferring comprises the step of receiving the data from the installed cable which simultaneously conducts a television signal.

44. The method of Claim 42, wherein the step of transmitting comprises the steps of:

converting an interface format data signal to an internal format data signal;

generating a modulated data signal at a frequency based on information included in the internal format data signal;

driving the modulated data signal to compensate for a characteristic impedance of the installed cable to provide a buffered modulated data signal; and

setting a switch direction that electrically couples the buffered modulated data signal to the installed cable.

45. The method of Claim 43, wherein the step of receiving comprises the steps of:

setting a switch direction that electrically couples the data from the installed cable to provide a buffered modulated data signal;

receiving the buffered modulated data signal to compensate for a characteristic impedance of the installed cable;

generating an internal format data signal from the buffered modulated data signal using frequency shift keying demodulation based on a frequency of the buffered modulated data signal; and

converting the internal format data signal to an interface format data signal.

46. A cable transfer interface circuit that processes data using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to transmit the television signal over a television signal transmission line.

47. The cable transfer interface circuit of Claim 46, wherein the frequency range is about 800KHz to 1MHz.

48. The cable transfer interface circuit of Claim 46, wherein the television signal transmission line is a coaxial cable.

49. The cable transfer interface circuit of Claim 46, wherein the data is transmitted from a first device in a building to a second device in the building over the television signal transmission line.

50. A cable transfer interface circuit that transmits data from a data interface over a television signal transmission line during a transmit operation and that provides data from the television signal transmission line to the data interface during a receive operation, the data interface circuit comprising:

a converter that converts a first interface format data signal from the data interface to a transmit format data signal during the transmit operation;

a transmitter, responsive to the converter, that provides a transmit modulated data signal based on the transmit format data signal using frequency shift keying during the transmit operation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the television signal transmission line;

a switch, responsive to the transmitter, that electrically couples the transmit modulated data signal to the television signal transmission line during the transmit operation;

wherein the switch electrically couples data from the television signal transmission line to provide a receive modulated data signal during the receive operation;

a receiver, responsive to the switch, that provides a receive format data signal based on the receive modulated data signal to the converter interface during the receive portion using frequency shift keying demodulation in the frequency range that is not within the television signal frequency range used to conduct the television signal over the television signal transmission line; and

wherein the converter converts the receive format data signal to a second interface format data signal during the receive operation.

51. The cable transfer interface circuit of Claim 50, wherein the transmitter comprises:

a frequency shift keying modulator that generates a modulated data signal based on information included in the first interface format data signal; and

a transmit interface, responsive to the frequency shift keying modulator, that transmits the transmit modulated data signal over the television signal transmission line via the switch based on the modulated data signal, wherein the television signal transmission line has an impedance in a range between about 75 ohms and 25 ohms.

52. The cable transfer interface circuit of Claim 50, wherein the receiver comprises

a receive interface that receives data from the television signal transmission line to provide a modulated data signal;

a frequency shift keying demodulator, responsive to the receive interface, that demodulates the modulated data signal to provide a demodulated data signal; and

a level shifter, responsive to the frequency shift keying demodulator, that shifts a voltage level of the demodulated outer signal to provide the receive format data signal.

53. The cable transfer interface circuit of Claim 50, wherein the television signal transmission line is a coaxial cable.

54. The cable transfer interface circuit of Claim 50, wherein the transmitter is located in a building; and wherein data is transmitted over the television signal transmission line to a device in the building.

55. The cable transfer interface circuit of Claim 50, wherein the frequency range is between about 800KHz and 1 MHz.

56. A system for transferring data in a residence, the system comprising:

a cable, installed in the residence, that conducts a television signal and data transfers simultaneously;

a first cable transfer interface, electrically connected to the installed cable, that transfers data over the installed cable using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the installed cable;

a set-top box, electrically connected to the first cable transfer interface, that transfers data to the first cable transfer interface in response to input and distributes a video signal;

a second cable transfer interface, electrically connected to the installed cable, that transfers data over the installed cable using frequency shift keying modulation in the frequency range that is not within the television signal frequency range used to conduct the television signal over the installed cable;

a personal computer, electrically connected to the second cable transfer interface, that transfers data to the second cable transfer interface in response to transfers from the set-top box;

a television, responsive to the set-top box, that displays the video signal; and

a video cassette recorder electrically connected to the installed cable, that records the television signal and provides a recorded video signal to the television.

57. The system of Claim 56, wherein the frequency range is about 800KHz to 1MHz.

58. The system of Claim 57, wherein the cable is a coaxial cable.

59. A system for transferring data in a residence, the system comprising:

a cable, installed in the residence, that conducts a television signal and data transfers simultaneously;

a first cable transfer interface, electrically connected to the installed cable, that transfers data over the installed cable using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the installed cable;

a set-top box, electrically connected to the first cable transfer interface, that transfers data to the first cable transfer interface in response to input and distributes a video signal;

a second cable transfer interface, electrically connected to the installed cable, that transfers data over the installed cable using frequency shift keying modulation in the frequency range that is not within the television signal frequency range used to conduct the television signal over the installed cable; and

a personal computer, electrically connected to the second cable transfer interface, that transfers data to the second cable transfer interface in response to transfers from the set-top box.

60. The system of Claim 58, wherein the frequency range is about 800KHz to 1MHz.

61. The system of Claim 58, wherein the cable is a coaxial cable.

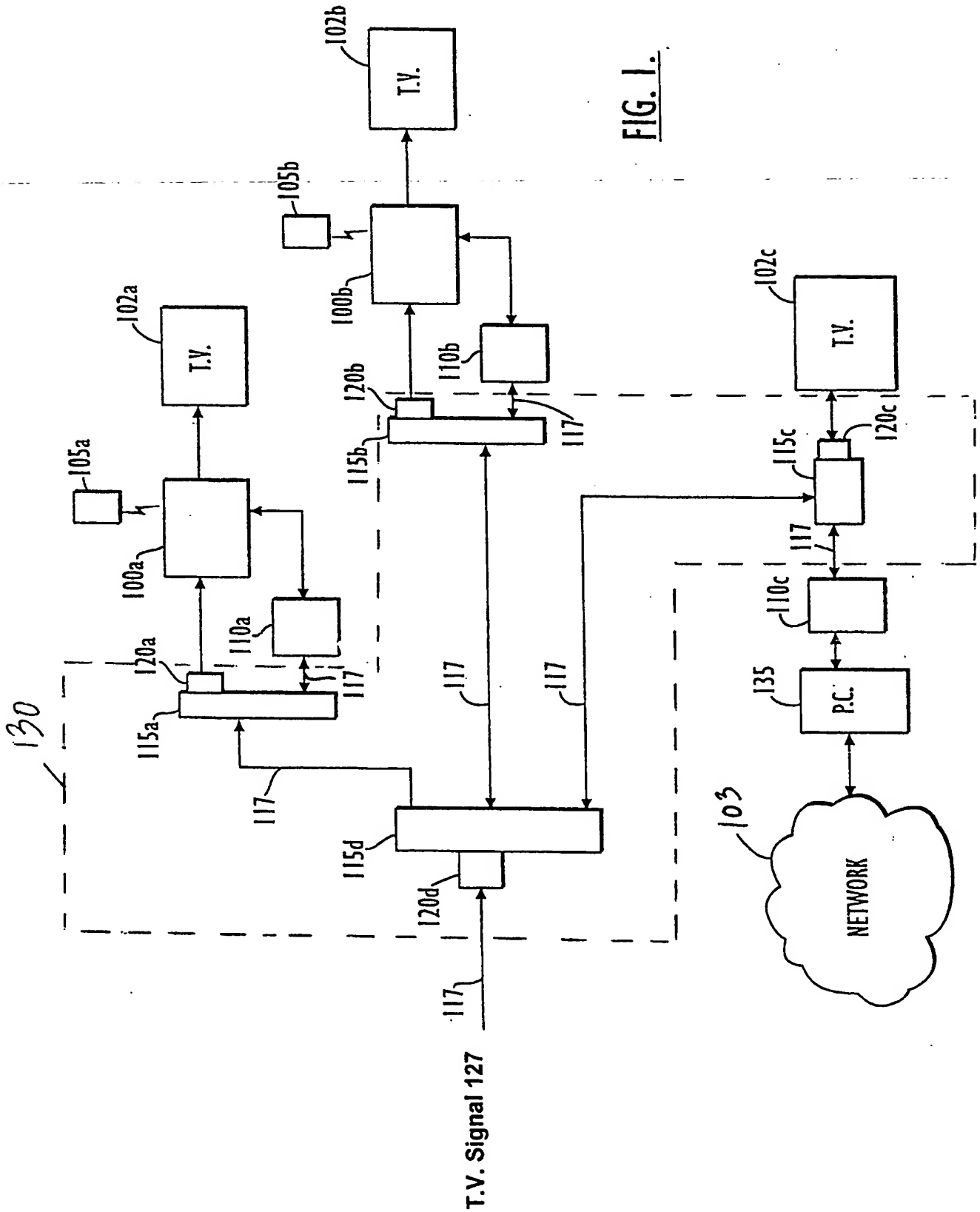
T.V.
T.V.
T.V.
T.V.
P.C.
NETWORK
T.V. Signal 127
130
103
135
100a
100b
102a
102b
102c
105a
105b
110a
110b
110c
115a
115b
115c
115d
117
120a
120b
120c
120d

FIG. 1.

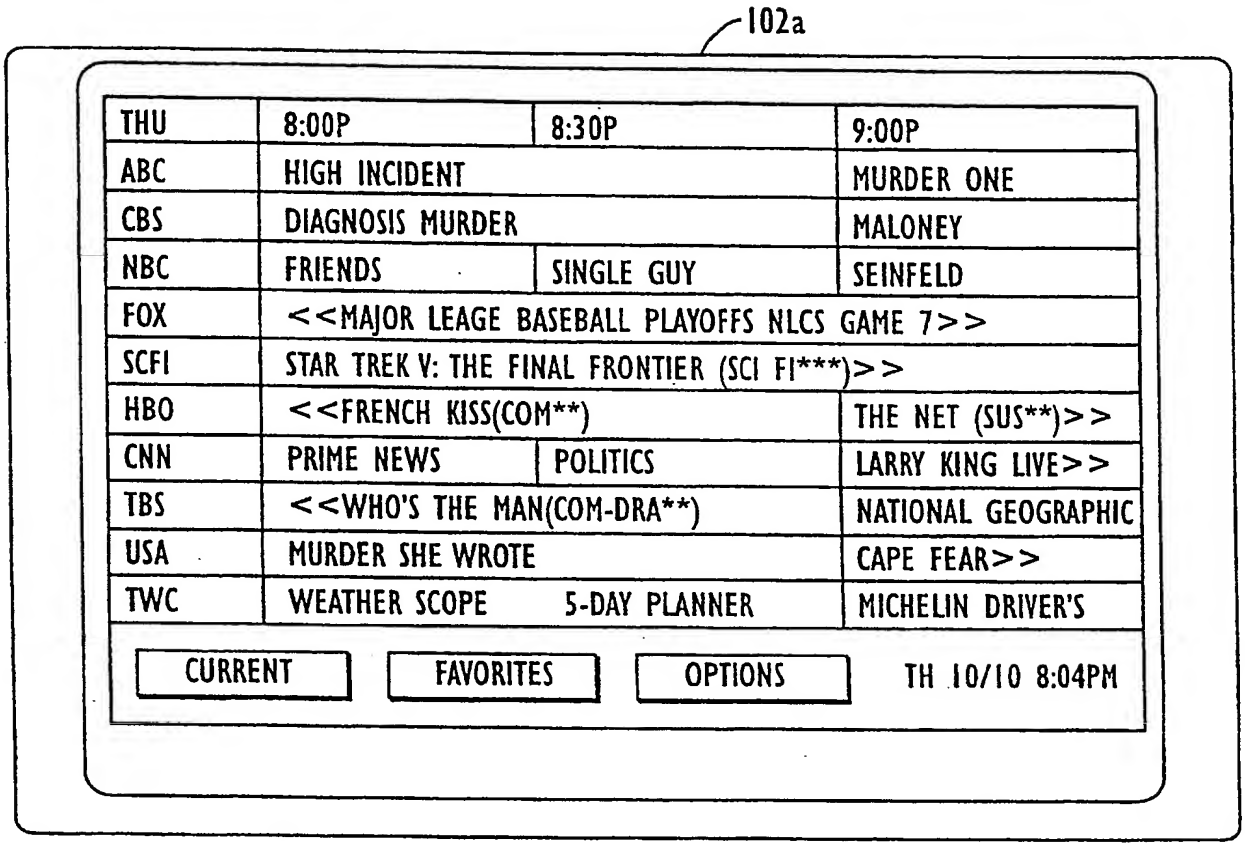
102a
THU
8:00P
8:30P
9:00P
ABC
HIGH INCIDENT
MURDER ONE
CBS
DIAGNOSIS MURDER
MALONEY
NBC
FRIENDS
SINGLE GUY
SEINFELD
FOX
<<MAJOR LEAGE BASEBALL PLAYOFFS NLCS GAME 7>>
SCFI
STAR TREK V: THE FINAL FRONTIER (SCI FI***)>>
HBO
<<FRENCH KISS(COM**)
THE NET (SUS**)>>
CNN
PRIME NEWS
POLITICS
LARRY KING LIVE>>
TBS
<<WHO'S THE MAN(COM-DRA**)
NATIONAL GEOGRAPHIC
USA
MURDER SHE WROTE
CAPE FEAR>>
TWC
WEATHER SCOPE
5-DAY PLANNER
MICHELIN DRIVER'S
CURRENT
FAVORITES
OPTIONS
TH 10/10 8:04PM

FIG. 2.

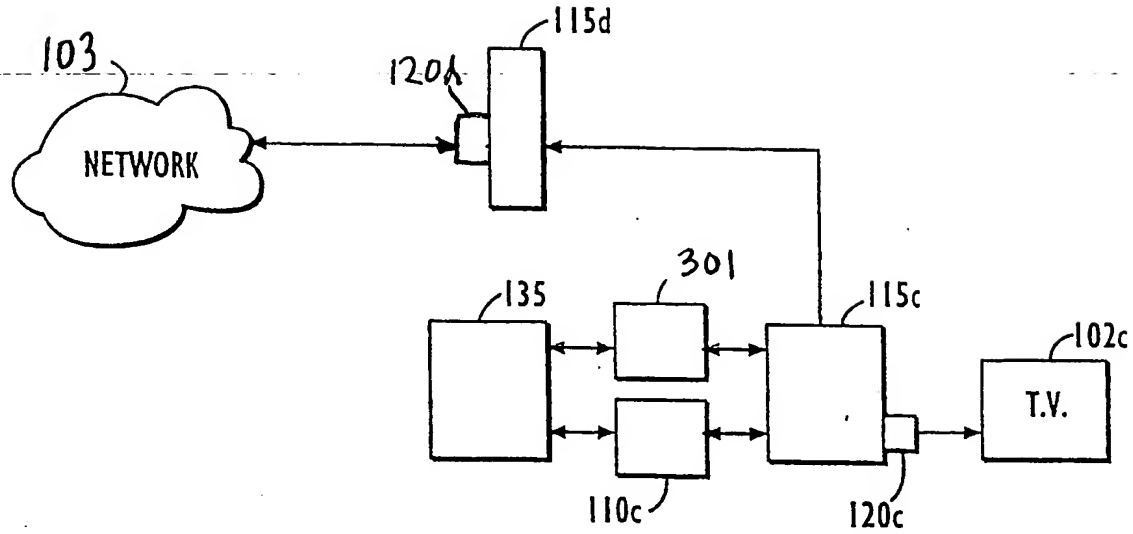

FIG. 3.

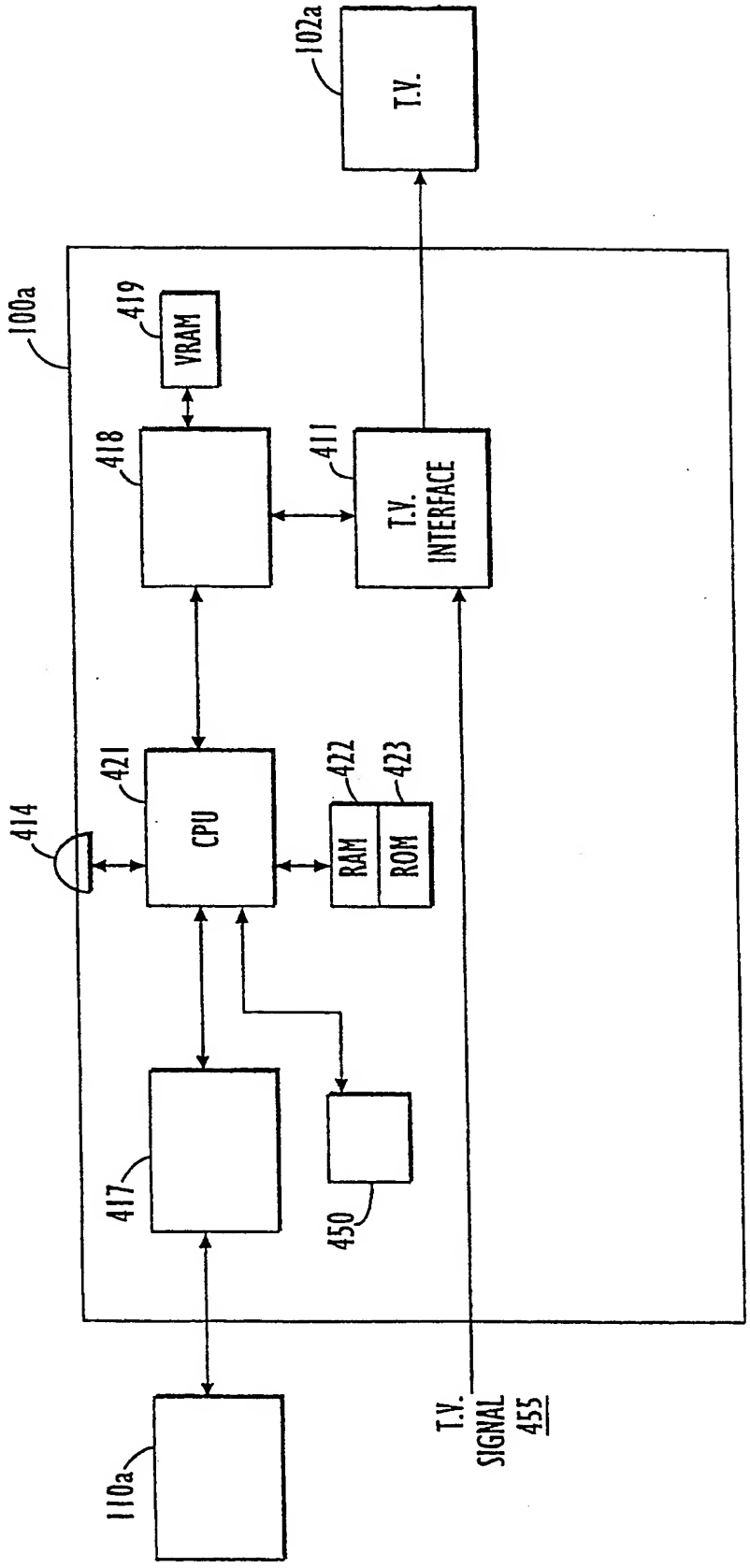
102a
T.V.
100a
419
VRAM
418
411
T.V. INTERFACE
421
CPU
422
423
RAM
ROM
414
417
450
110a
T.V. SIGNAL 455

FIG. 4.

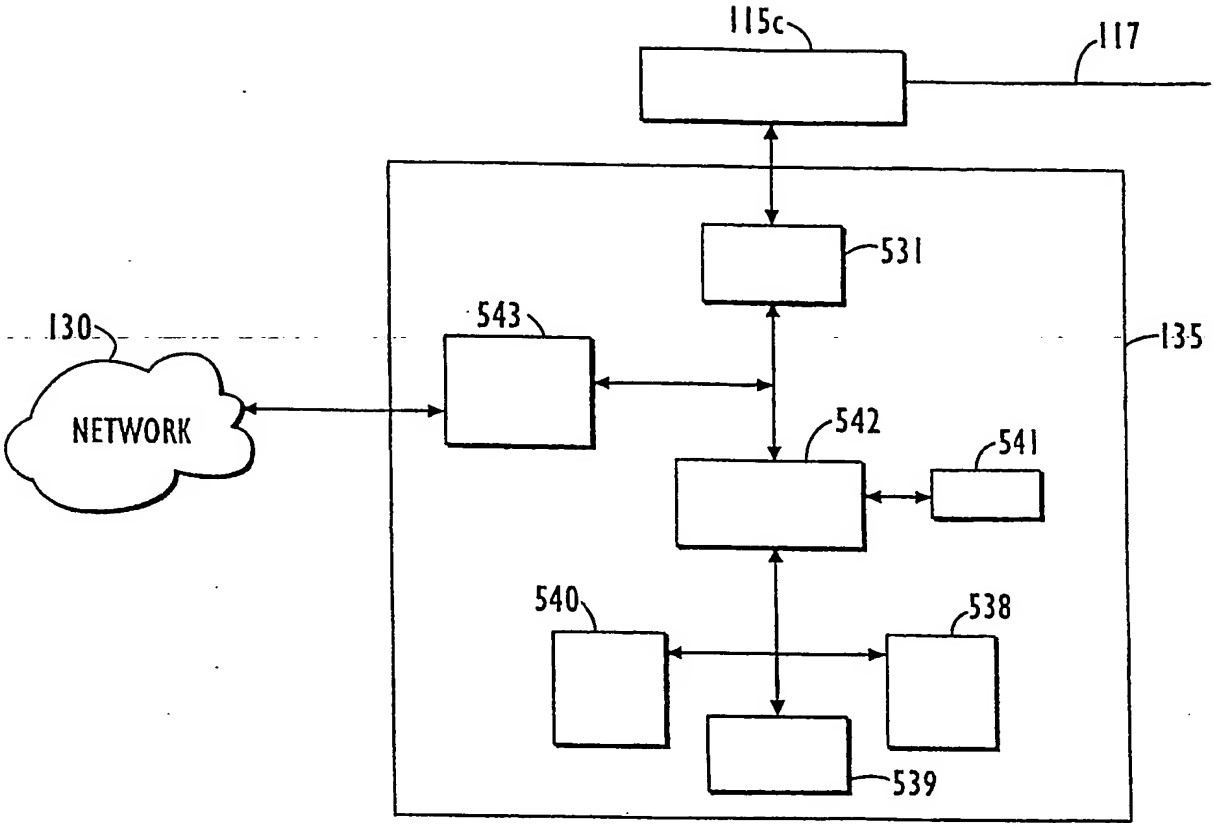

FIG. 5.

PACKET FORMAT

START	ID	INSTR	LENGTH	[DATA]	CKSUM	STOP
BYTE	WORD	BYTE	WORD	nBYTES	WORD	BYTE

FIG. 6.

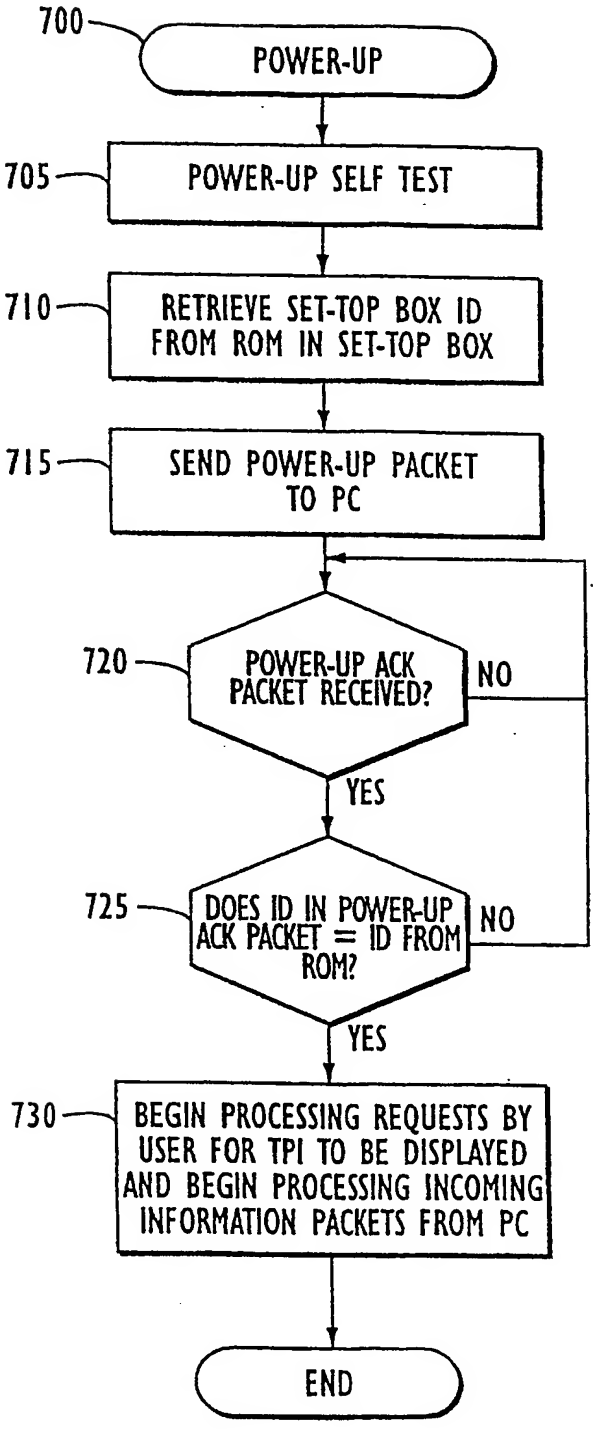
700
POWER-UP
705
POWER-UP SELF TEST
710
RETRIEVE SET-TOP BOX ID FROM ROM IN SET-TOP BOX
715
SEND POWER-UP PACKET TO PC
720
POWER-UP ACK PACKET RECEIVED?
NO
YES
725
DOES ID IN POWER-UP ACK PACKET = ID FROM ROM?
NO
YES
730
BEGIN PROCESSING REQUESTS BY USER FOR TPI TO BE DISPLAYED AND BEGIN PROCESSING INCOMING INFORMATION PACKETS FROM PC
END

FIG. 7.

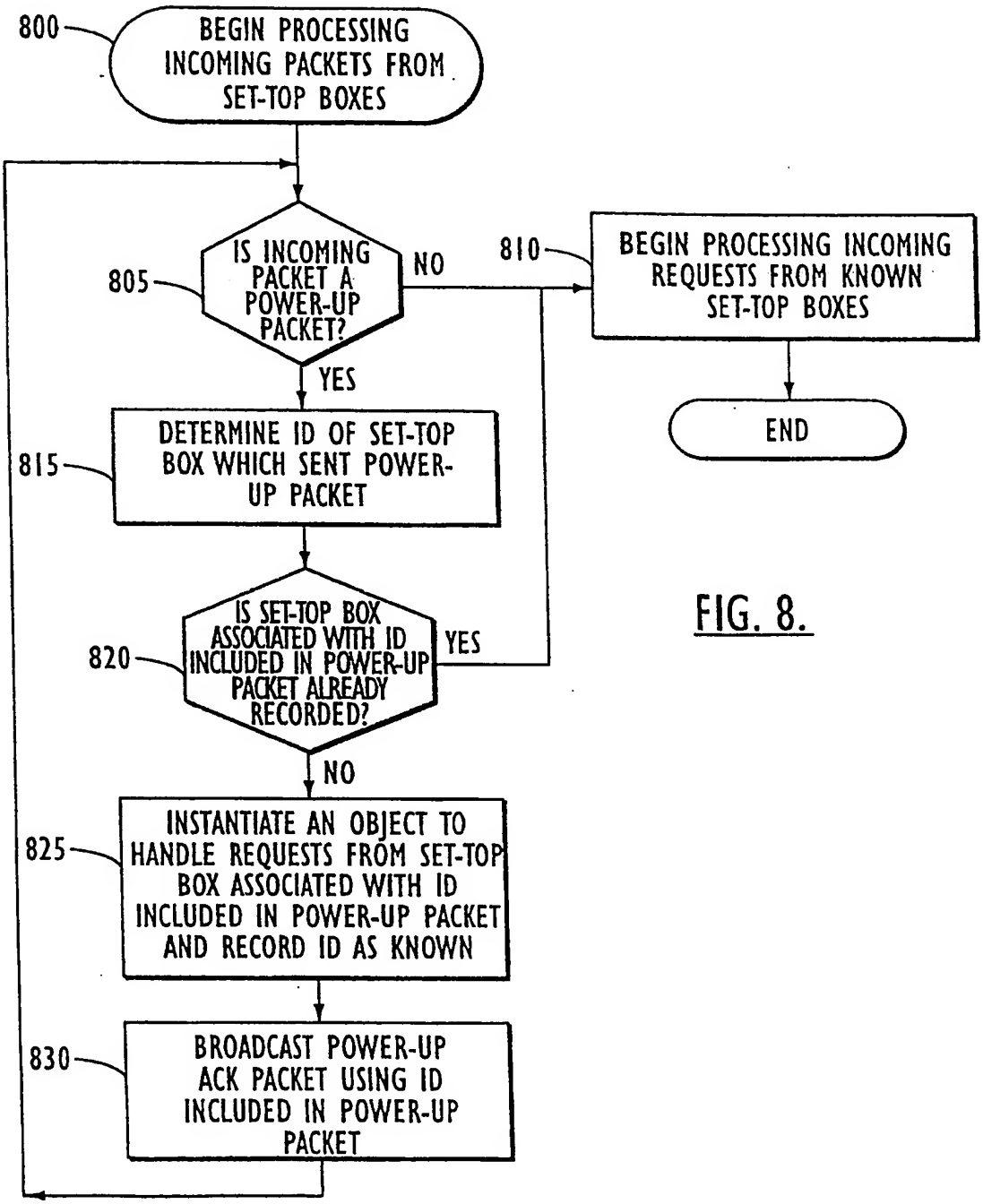
800
BEGIN PROCESSING INCOMING PACKETS FROM SET-TOP BOXES
805
IS INCOMING PACKET A POWER-UP PACKET?
NO
810
BEGIN PROCESSING INCOMING REQUESTS FROM KNOWN SET-TOP BOXES
END
YES
815
DETERMINE ID OF SET-TOP BOX WHICH SENT POWER-UP PACKET
820
IS SET-TOP BOX ASSOCIATED WITH ID INCLUDED IN POWER-UP PACKET ALREADY RECORDED?
YES
NO
825
INSTANTIATE AN OBJECT TO HANDLE REQUESTS FROM SET-TOP BOX ASSOCIATED WITH ID INCLUDED IN POWER-UP PACKET AND RECORD ID AS KNOWN
830
BROADCAST POWER-UP ACK PACKET USING ID INCLUDED IN POWER-UP PACKET

FIG. 8.

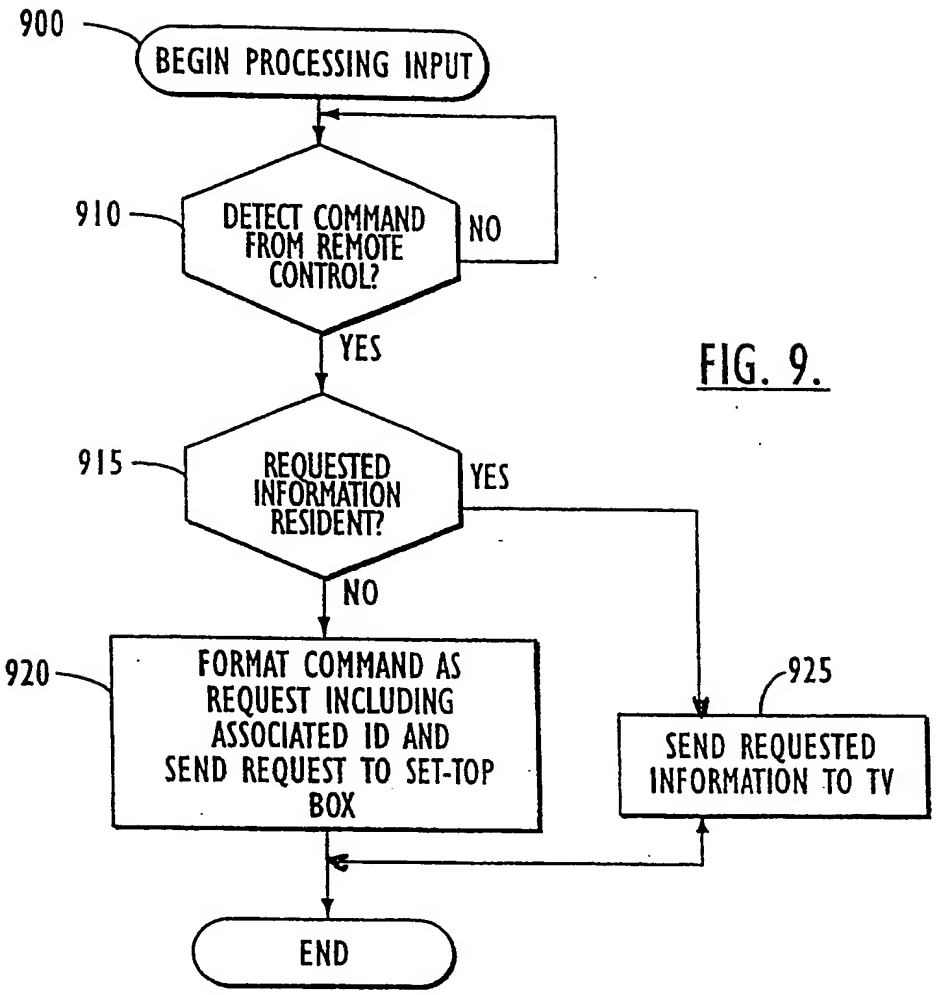
900
BEGIN PROCESSING INPUT
910
DETECT COMMAND FROM REMOTE CONTROL?
NO
YES
915
REQUESTED INFORMATION RESIDENT?
YES
NO
920
FORMAT COMMAND AS REQUEST INCLUDING ASSOCIATED ID AND SEND REQUEST TO SET-TOP BOX
925
SEND REQUESTED INFORMATION TO TV
END

FIG. 9.

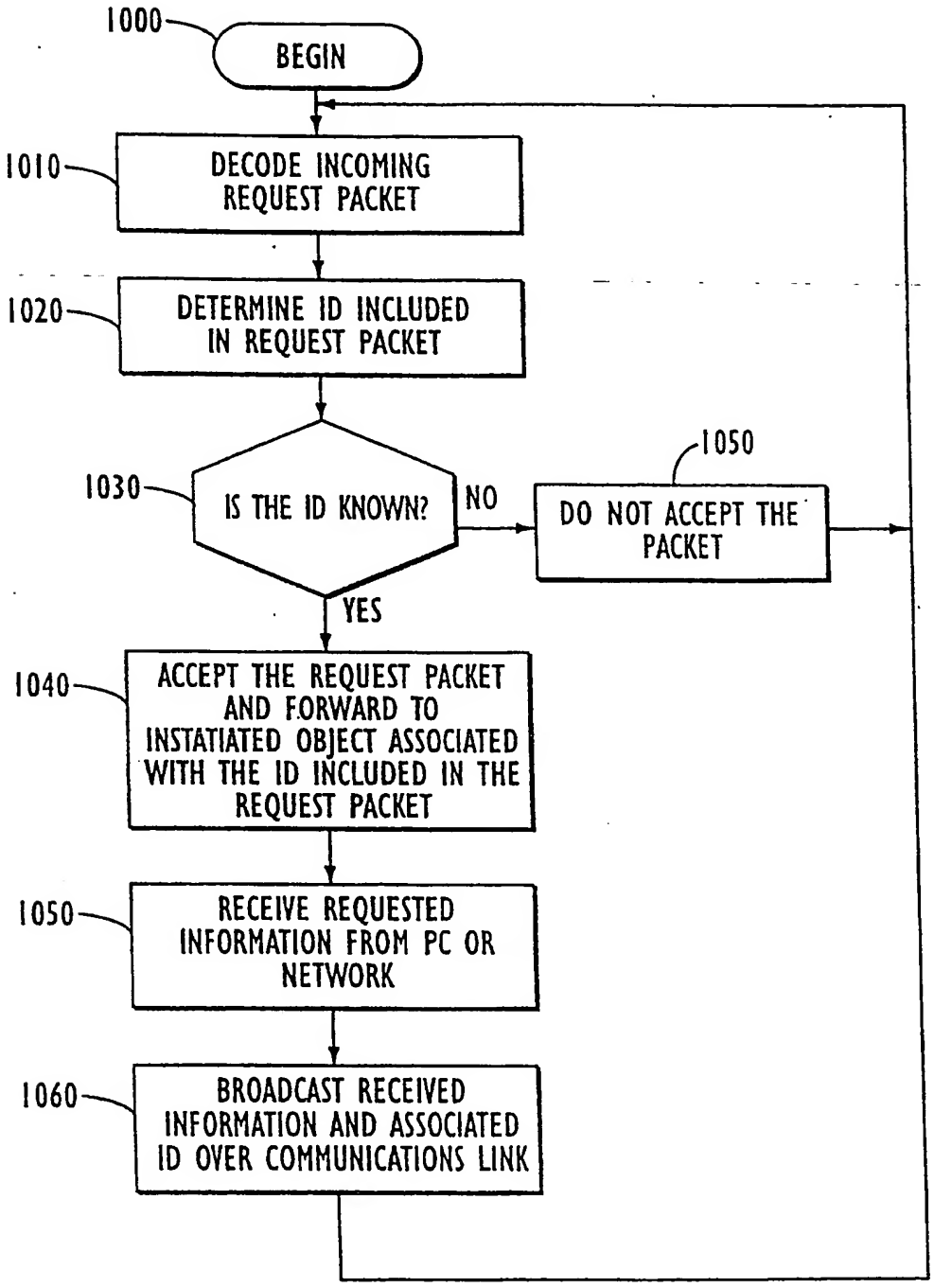
1000
BEGIN
1010
DECODE INCOMING REQUEST PACKET
1020
DETERMINE ID INCLUDED IN REQUEST PACKET
1030
IS THE ID KNOWN?
NO
1050
DO NOT ACCEPT THE PACKET
YES
1040
ACCEPT THE REQUEST PACKET AND FORWARD TO INSTATIATED OBJECT ASSOCIATED WITH THE ID INCLUDED IN THE REQUEST PACKET
1050
RECEIVE REQUESTED INFORMATION FROM PC OR NETWORK
1060
BROADCAST RECEIVED INFORMATION AND ASSOCIATED ID OVER COMMUNICATIONS LINK

FIG. 10.

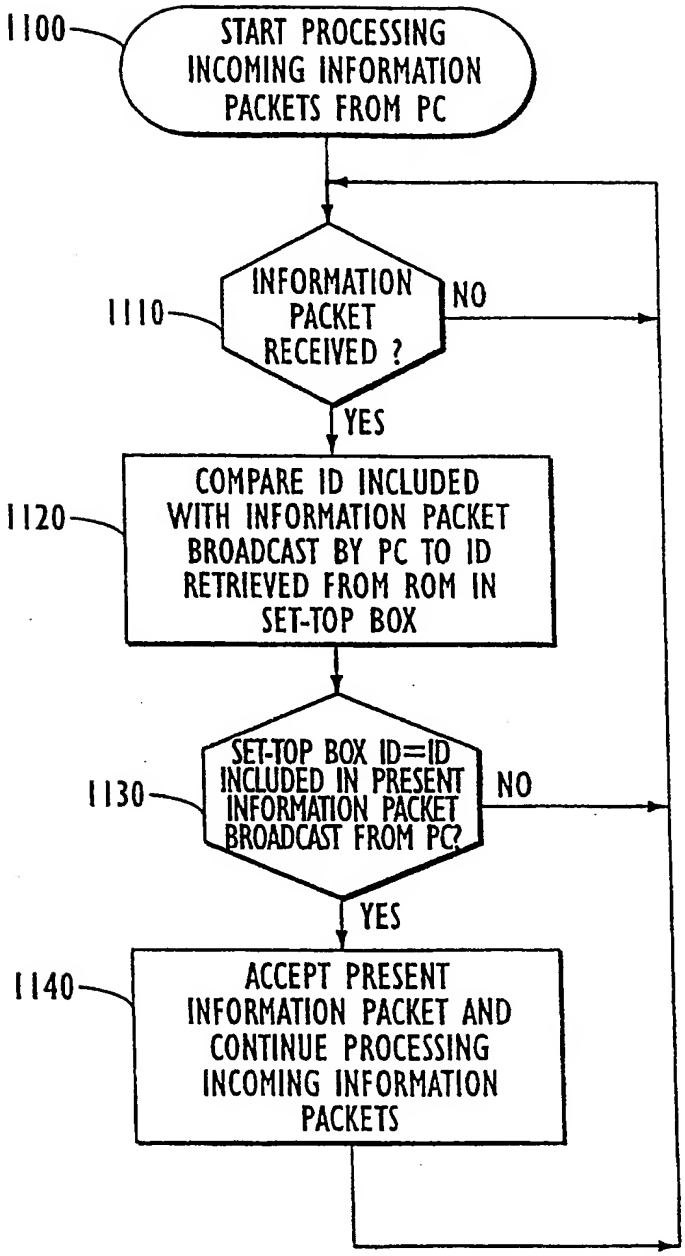
1100
START PROCESSING INCOMING INFORMATION PACKETS FROM PC
1110
INFORMATION PACKET RECEIVED ?
NO
YES
1120
COMPARE ID INCLUDED WITH INFORMATION PACKET BROADCAST BY PC TO ID RETRIEVED FROM ROM IN SET-TOP BOX
1130
SET-TOP BOX ID=ID INCLUDED IN PRESENT INFORMATION PACKET BROADCAST FROM PC?
NO
YES
1140
ACCEPT PRESENT INFORMATION PACKET AND CONTINUE PROCESSING INCOMING INFORMATION PACKETS

FIG. 11.

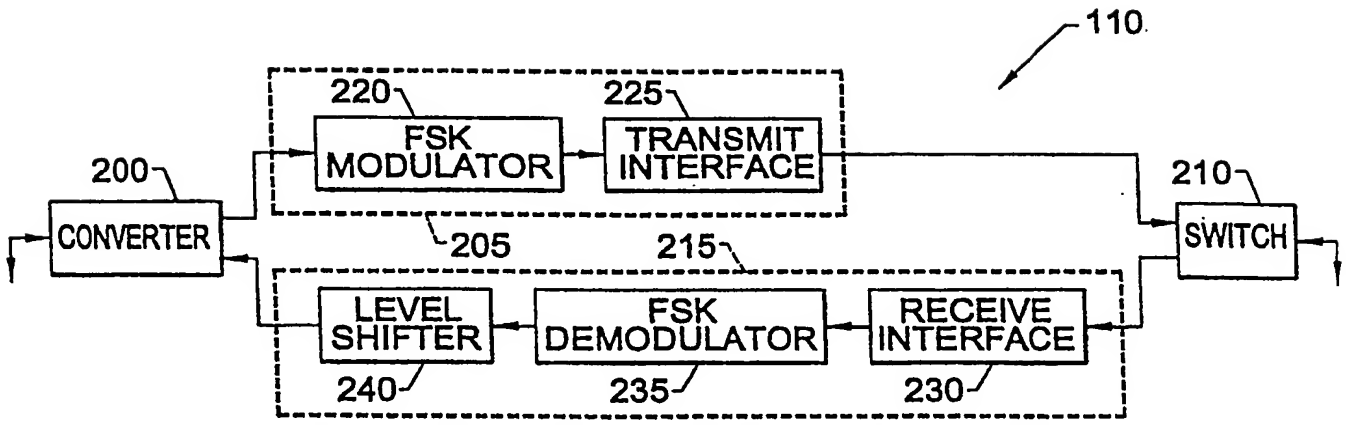
110
220
225
FSK MODULATOR
TRANSMIT INTERFACE
200
210
CONVERTER
205
215
SWITCH
LEVEL SHIFTER
FSK DEMODULATOR
RECEIVE INTERFACE
240
235
230

FIG.12.

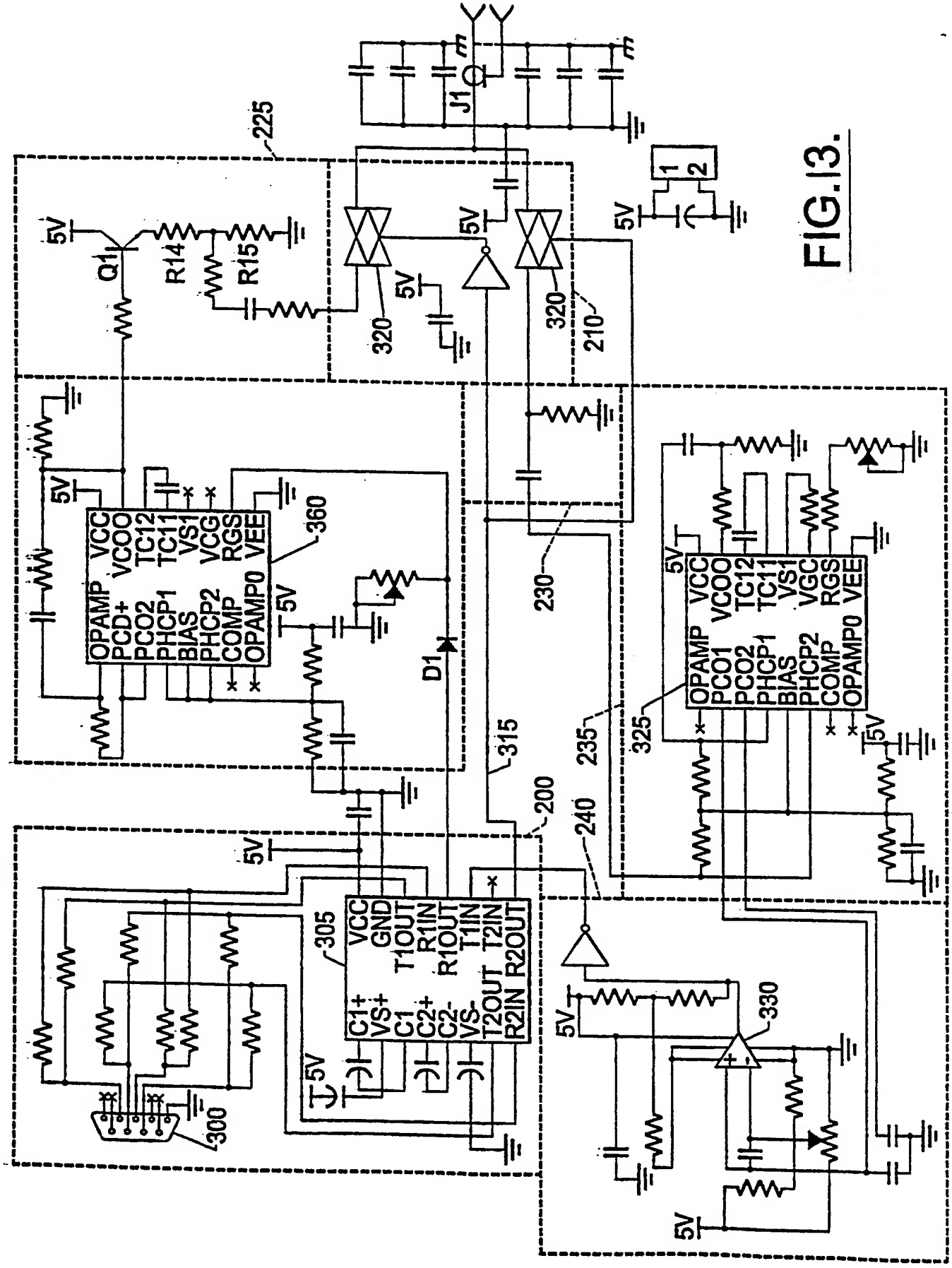
J1
225
Q1
R14
R15
320
210
230
360
D1
315
200
240
235
325
305
330
300
5V
VCC
GND
T1OUT
R1IN
R1OUT
T1IN
T2IN
R2OUT
C1+
VS+
C1-
C2+
C2-
VS-
T2OUT
R2IN
OPAMP
PCO1
PCO2
PHCP1
BIAS
PHCP2
COMP
OPAMP0
VEE
VGC
RGS
TC11
TC12
VCOO

FIG.13.

INTERNATIONAL SEARCH REPORT

Internatl. Application No
PCT/US 00/02303

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 255 086 A (MCMULLAN JR JAY C ET AL) 19 October 1993 (1993-10-19) column 5, line 22 -column 7, line 13 column 10, line 15 -column 11, line 32 column 13, line 29 - line 47 abstract; figures 1,3 --- -/--	1-61

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 July 2000	13/07/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	La, V

1

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INTERNATIONAL SEARCH REPORT

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PCT/US 00/02303

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 822 718 A (DISCOVERY COMMUNICAT INC) 4 February 1998 (1998-02-04) page 3, line 47 -page 5, line 5 page 11, line 56 -page 12, line 6 page 18, line 7 -page 20, line 49	1-3,5,6, 8-14,16, 18-27, 29, 31-36, 39-43, 46-49
A	abstract; figures 1,10	4,7,15, 17,28, 30,37, 38,44, 45,50-61

X	WO 97 20413 A (NOKIA OY AB ;HAKULINEN HARRI (FI)) 5 June 1997 (1997-06-05)	1,11,13, 21,26
A	abstract; claim 1; figure 5	2-10,12, 14-20, 22-25, 27-61

X	US 5 657 414 A (RALEY MICHAEL ET AL) 12 August 1997 (1997-08-12) abstract; figure 1 column 5, line 37 - line 49 column 11, line 23 - line 29	33-36, 39-43, 46-49
A	column 12, line 21 - line 27	1-32,37, 38,44, 45,50-61

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A	abstract; figure 1	1-32,37, 38,44, 45,50-61

P,X	WO 99 35831 A (SCHULTHEISS CHRISTOPHER J ;CUTLER TODD D (US); SUPERGUIDE CORP (US) 15 July 1999 (1999-07-15)	1,11,13, 21,26
P,A	abstract; figures 1A,4B	2-10,12, 14-20, 22-25, 27-61

A	WO 98 03012 A (SCHULTHEISS CHRISTOPHER J ;BROWN DOUGLAS G (US)) 22 January 1998 (1998-01-22) abstract; figure 1	1-61

	-/--	

1

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US 00/02303

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 13368 A (BRIEN SEAN ANDREW O ;MILNES KENNETH ALAN (US); SCHEIN STEVEN MICHA) 10 April 1997 (1997-04-10) abstract; figure 1	1-61
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A	EP 0 727 909 A (SONY CORP) 21 August 1996 (1996-08-21) abstract; figure 1	1-61

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

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		DE 69130642 D	28-01-1999
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		EP 0532504 A	24-03-1993
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		ES 2108711 T	01-01-1998
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		MX 174456 B	17-05-1994
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		US 5225902 A	06-07-1993
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		CA 2078548 A	21-09-1991
		CN 1056787 A	04-12-1991
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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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WO 00/45601 A1

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(21) International Application Number: PCT/US00/02303

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(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/239,215 29 January 1999 (29.01.1999) US
09/370,561 9 August 1999 (09.08.1999) US

(71) Applicant: BROWN, Douglas, G. [US/US]; 108 Wyndham Cove, Cherryville, NC 28021 (US).

(71) Applicant and
(72) Inventor: SCHULTHEISS, Christopher, J. [US/US]; 419 Quay Assisi Street, New Smyrna Beach, FL 32169-3604 (US).

(72) Inventors: CLARK, Jerry, R.; 13560 Crestmoor Drive, Farmers Branch, TX 75234-5123 (US). CUTLER, Todd, D.; 101 North Bean, Howe, TX 75459 (US). MONACO, Lawrence, D.; 2410 Bluebonnet Drive, Richardson, TX 75082-2322 (US).

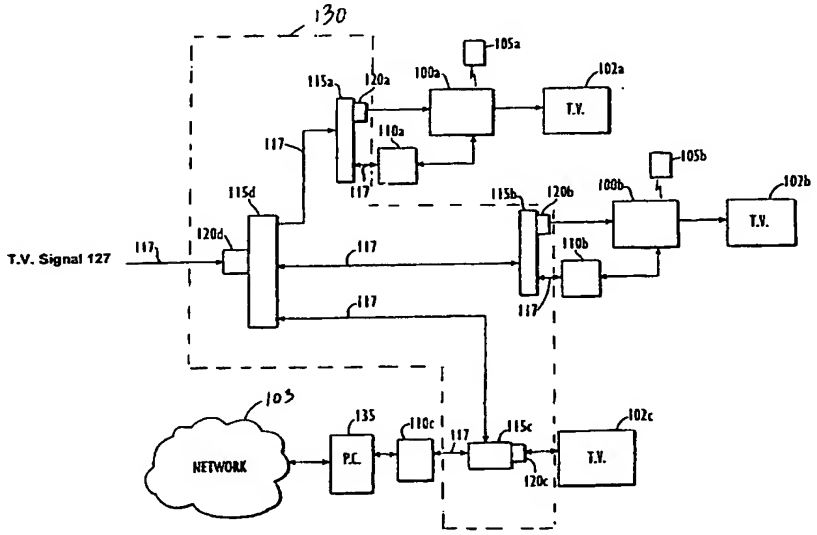
(74) Agents: CROUSE, Robert, N. et al.; Myers, Bigel, Sibley & Sajovec, P.A., P.O. Box 37428, Raleigh, NC 27627 (US).

(81) Designated States *(national)*: AE, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), EE, EE (utility model), ES, FI, FI (utility model), GB, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU,

[Continued on next page]

(54) Title: METHODS AND SYSTEMS FOR PROVIDING INFORMATION TO SET-TOP BOXES HAVING SET-TOP BOX IDENTIFIERS USING FREQUENCY SHIFT KEYING MODULATION



(57) Abstract: A set-top box is provided wherein an Identifier (ID) associated with the set-top box can be used to request information from a personal computer which provides the requested information to the set-top box. In particular, in a system that includes multiple set-top boxes, the ID can be used to determine which set-top box made a request and to determine which set-top box is the intended recipient of the requested information accessed by the system. The information can be provided over a cable which is used to connect a television signal. In particular, the information can be transferred using frequency shift keying modulation.

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METHODS AND SYSTEMS FOR PROVIDING INFORMATION TO SET-TOP BOXES HAVING SET-TOP BOX IDENTIFIERS USING FREQUENCY SHIFT KEYING MODULATION

Field of the Invention

The present invention relates to the field of communications in general, and more particularly, to data transmission.

Background of the Invention

The television (TV) has become ubiquitous in modern society. As a result, a variety of services are being provided via TV. Many of the services are provided using a set-top box that works in conjunction with the TV to provide the desired service. One example of a service provided via a TV is an online TV program guide, wherein TV program schedule information is displayed on a TV for searching and selection by a viewer. Online TV program guides are described in U.S. Patent 4,751,578 to Reiter et. al. entitled *System for Electronically Controllable Viewing on a Television Updateable Television Programming Information.* Other popular services are also provided using a set-top box. For example cable or satellite TV may be provided using a tuner packaged as a set-top box. The tuner decodes the transmission from the service provider and formats the signal for display on the TV. Moreover, many households have more than one TV.

It is also known to provide some services over the Internet using set-top boxes. One such service is WebTV which enables a user to browse the Web using a TV as the display. WebTV, however, duplicates much of the hardware and software included in a standard PC. For example, WebTV includes a modem while many PCs come equipped with one. Consequently, the consumer who already owns a PC may pay the cost of the modem twice: once when buying the PC and a second time when buying WebTV. Furthermore, WebTV may also duplicate a portion of the functions found in most TVs.

This duplication of PC and TV components may make WebTV unnecessarily expensive or complex to the many consumers who already own a PC.

As the popularity of TV and services increase, it may become more desirable to provide multiple users in the same household with the capability to use services separately. Unfortunately, the cost to provide multiple TV users separate access to the services described above may be prohibitive. For example, viewers of different TVs may desire separate information.

Furthermore, as the popularity of cable television services increases, new consumer devices may become available for home use. For example, new types of consumer devices such as cable ready televisions, cable tuners, and video cassette recorders may be connected to cabling which carries the transmission of the cable television services for use by consumers in their homes. As the number of consumer devices used in the home increases, the cabling needed inside the home may also increase and become unwieldy. As a result, the cabling may be integrated into the structure of the home, for example in the walls and floors. It is known to use coaxial cable having an impedance of 75 ohms in some cable systems for the transmission of the cable television services.

The cabling may conduct television signals and other signals which include the cable television services, and Direct Current (DC) voltages or Alternating Current (AC) voltages for controlling the consumer devices. For example, a television signal and a DC voltage may be transmitted over the cabling to provide a video signal and a DC voltage for controlling a cable tuner.

Personal Computers also may be capable of communicating with other devices, such as the consumer devices described above. Unfortunately, separate wiring may be needed to provide the communications between the devices. For example, a serial data cable may be needed to connect two PCs. Unfortunately, if the PCs are located in different areas of the home, the serial data cable may need to be long which may make the serial data cable expensive and unwieldy. Therefore, a need exists to further improve methods and systems for providing services via consumer devices and PCs.

Summary of the Invention

It is an object of the present invention to provide improved set-top boxes for use with television services.

It is another object of the present invention to provide improved systems for the use of multiple set-top boxes.

It is, therefore, an object of the present invention to allow an improvement in the transfer of data between devices within a building.

It is another object of the present invention to allow improvement in transferring data over transmission lines which conduct television signals.

These and other objects of the present invention may be provided by set-top boxes, identified by respective identifiers (IDs), that send requests for information to a PC over a television signal transmission line. The request can include the ID of the set-top box that made the request. When the requested information is accessed, the requested information and the ID of the set-top box that made the request can be transmitted over the communications link to the set-top box using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal on the television signal transmission line. Accordingly, multiple set-top boxes may access information from a single residence via an existing PC, thereby allowing a more cost-effective approach than conventional systems.

In one embodiment, a computer program running on the PC can handle requests from the plurality of set-top boxes. In another embodiment, a computer program can be instantiated for each of the plurality of set-top boxes. For example, a first computer program can be instantiated to handle requests from the first set-top box and a second computer program can be instantiated to handle requests from the second set-top box.

The frequency shift keying modulation can be provided by generating a modulated data signal based on information included in the data. For example, the frequency shift keying modulation can generate a modulated data signal at a first frequency when the data is equal to a logical 0 and at a second frequency when the data is equal to a logical 1. In one embodiment, the first frequency is about 800KHz and the second frequency is about 1MHz.

Frequency shift keying modulation may provide a reduction in the cost of transferring data. In particular, the frequency shift keying modulation may be embodied using relatively few components. In contrast, some conventional data transfers are performed using phase shift keying modulation which may be more expensive than a system according to the present invention.

Brief Description of the Drawings

FIG. 1 is a block diagram of a first embodiment of systems and methods according to the present invention.

FIG. 2 is an exemplary display of information provided to a user on a TV.

FIG. 3 is a block diagram of a second embodiment of systems and methods according to the present invention.

FIG. 4 is a block diagram of an embodiment of a set-top box according to the present invention.

FIG. 5 is a block diagram of an embodiment of a PC according to the present invention.

FIG. 6 is an embodiment of a packet structure according to the present invention.

FIG. 7 is a flowchart that illustrates initialization operations of a set-top box according to the present invention.

FIG. 8 is a flowchart that illustrates initialization operations of a computer program running on the PC in coordination with the operations illustrated in **FIG. 7**.

FIG. 9 is a flowchart that illustrates operations of a set-top box in response to requests for information.

FIG. 10 is a flowchart that illustrates operations of the computer program running on the PC in response to incoming requests for information from set-top boxes.

FIG. 11 is a flowchart that illustrates operations of a set-top box in response to information broadcast by the PC.

FIG. 12 is a block diagram of a cable transfer interface according to the present invention.

FIG. 13 is a schematic diagram of an exemplary embodiment of a cable transfer interface according to the present invention.

Detailed Description of the Invention

The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which a preferred embodiment of the invention is shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

The phrase "television signal" as used herein includes signals formatted for display on television sets such as National Television System Committee (NTSC) format video provided in some conventional cable television systems. NTSC formatted video includes 525 lines at a horizontal frequency of 15.734 KHz and a vertical frequency of 60 Hz. Other signals formatted for display on television also are included. As described herein the phrase "transmit operation" refers to the transmission of data from a PC to a set-top box over a transmission line. Similarly, the phrase "receive operation" refers to the transmission of data from the set-top box to the PC. Like numbers refer to like elements throughout.

As will be appreciated by one of skill in the art, the present invention may be embodied as a method, data processing system and/or program product. Accordingly, the present invention may take the form of an entirely hardware embodiment, an entirely software embodiment or an embodiment combining software and hardware aspects. Furthermore, the present invention may take the form of a computer program product on a computer-readable storage medium having computer-readable program code means embodied in the medium. Any suitable computer readable medium may be utilized including hard disks, CD-ROMs, optical storage devices, or magnetic storage devices.

The present invention is also described using block diagrams and flowcharts. Those skilled in the art will understand that the blocks in the block diagrams and the flowchart illustrations, and combinations of blocks, may be implemented with various commonly used components. It will also be understood that portions of the operations described in the blocks may be executed as computer program instructions loaded into a computer or other data processing apparatus, thus producing a machine which provides means for implementing the functions specified in the flowchart blocks and combinations

thereof. The computer program may cause operational steps to be performed on the computer or data processing apparatus to produce a computer-implemented process such that the instructions which execute on the computer or data processing apparatus provide steps for implementing the functions of the blocks or combinations thereof. Accordingly, the blocks support combinations of means for performing the specified functions and combinations of steps for performing the specified functions.

FIG. 1 is a block diagram that illustrates systems and methods according to a first embodiment of the present invention. According to the embodiment of **FIG. 1**, the system can include a plurality of set-top boxes **100a-b**, each of which accepts requests from respective remote controls **105a-b**. According to **FIG. 1**, a user pushes buttons on the remote control **105a** to request the display of information on a TV **102a**. The remote control **105a** transmits a corresponding command to the set-top box **100a** associated with the remote control. It will be understood that functions of the remote control alternately can be provided directly on the set-top box and/or the remote control can be coupled to the set-top box via means such as a cable, RF coupling and/or IR coupling. The set-top box **100a** can send a request for the information to a Personal Computer (PC) **135** over a communications link **130**. Each set-top box **100a-b** can request different information from the PC **135**, which responds by accessing the requested information locally or via a network **103**, such as the Internet. As used herein, the term "information" includes information such as television program information (such as that shown in **FIG. 2**), e-mail, chat, sports scores, weather and the like. Set-top boxes are discussed in U.S. Patent Application No. 09/005269 entitled *Methods and Systems for Providing Television Related Services via a Networked Personal Computer"* which is commonly assigned to the assignee of the present application and which is incorporated herein by reference.

Each request for information by a set-top box **100a-b** can include an Identifier (ID) that identifies the set-top box **100a-b** which made the request. For example, the first set-top box **100a** can be identified by a first ID of FF_{16} and the second set-top box **100b** can be identified by a second ID of $F0_{16}$. Requests sent to the PC **135** by the first set-top box **100a** include the first ID FF_{16} and requests sent to the PC **135** by the second set-top box **100b** include the second ID $F0_{16}$. The PC **135** can use the respective IDs of the first

and second set-top boxes **100a-b** to associate each received request with the set-top box that sent the request.

The PC **135** can access the requested information and can broadcast the requested information and the ID of the set-top box **100a-b** that made the request over the communications link **130**. For example, the PC **135** can broadcast information requested by the first set-top box **100a** with the first ID FF_{16} and can broadcast information requested by the second set-top box **100b** with the second ID $F0_{16}$ over the communications link **130**.

Each set-top box **100a-b** can receive the information and the associated ID broadcast by the PC **135**. Each set-top box **100a-b** can compare the ID included with the information broadcast by the PC **135** to the ID stored in the set-top box **100a-b**. For example, when the PC **135** broadcasts the information requested by the first set-top box **100a**, the PC **135** includes the first ID. Accordingly, the first set-top box **100a** compares the ID associated with the first information broadcast by the PC **135** to the ID associated with the first set-top box **100a**. When a match occurs, the first set-top box **100a** accepts the information and provides it to the TV **102a**. Moreover, the second set-top box **100b** compares the ID associated with the first information broadcast by the PC **135** to the ID associated with the second set-top box **100b**. When a mismatch occurs, the second set-top box **100b** does not accept the information.

The communications link **130** can be any communications medium known to those having skill in the art. In one embodiment, the communications link **130** can be a cable **117** such as those used to provide cable service to residential customers. Each set-top box **100a-b** and the PC **135** can be electrically coupled to the cable **117** via respective Cable Transfer Interfaces (CTI) **110a-c**. In particular, each set-top box **100a-b** can send requests for information over the cable **117** through the associated CTI **110a-b**. The PC **135** can receive the requests and can broadcast requested information through the associated CTI **110c**. The cable **117** couples the CTIs **110a-c** to one another through cable splitters **115 a-d**. The cable splitters **115a-d** can be used to distribute an input signal to multiple outputs while maintaining the proper termination for the cable **117**. Direct Current (DC) blocking circuits **120a-e** can be used to filter DC voltage levels

provided by some cable systems and fed back by some TVs and set-top boxes on the cable **117**.

The set-top box **100a** can request information by sending requests to the PC **135** and can receive the corresponding information from the PC **135** over the communications link **130** according to a command protocol described herein. User commands received from the remote control **105a** are processed by the set-top box **100a** to determine what action is necessary to display the desired information. If the requested information is not available within set-top box **100a**, the set-top box **100a** can send a request for the information to the PC **135**. In response, the information requested by the set-top box **100a** can be broadcast over the communications link **130** by the PC **135** and can be received by the appropriate set-top box **100a** which formats the information for display on the TV **102a**.

A request can include computer commands organized to access the information requested by the user via the remote control **105a**. For example, the request may comprise a list of instructions which cause the PC **135** to access the network **130** and issue some of the commands included in the request to the network **130**. In one embodiment, the access to the network can be provided using a telephone line. In the alternate embodiment of **FIG. 3**, access to the network can be provided by the cable system via a cable modem **301**.

As shown in **FIG. 4**, the set-top box **100a** can include a central processing unit (CPU) or controller **421**, a Random Access Memory (RAM) **422**, a Read Only Memory (ROM) **423**, a Video Processing system (VP) **418**, a Video Buffer (VRAM) **419**, a TV interface **411**, a Communication Link Interface (CLI) **417**, and a wireless infra-red (IR) sensor **414**. In one embodiment, the ID of the set-top box **100a** can be stored in the ROM **423**. In another embodiment, the ID can be encoded by switches **450**, the settings of which can be read by the CPU **421**. The above components are well known to those having skill in the art and need not be described further herein.

The CPU **421** may be suitable for running a computer program to process information from the PC **135**, processes user commands from the remote control **105a**, control the formatting of information for display on the TV **102a**, and provide general system services to the set-top box **100a**. The CPU **421** may process user commands

received from the remote control **105a** as a stream of serial data. For example, if the user pushes a button on the remote control **105a** that corresponds to a command requiring information from the network **103**, the CPU **421** receives the command in an internal serial buffer from the IR sensor **415**. The CPU **421** sends a corresponding computer command to the CLI **417** and the command is transmitted over communications link to the PC **135** via the CTI **110a** and the network **103**. The CPU **421** may also process information from the PC **135**. For example, when information is returned from the network **130**, it is received by the CLI **417**. The CPU **421** accepts the information from the CLI **417** as a stream of serial data. In one embodiment, the CPU **421** may process the data received from the remote control **105a** and information from the PC **135** and the network **103** as a single serial data stream.

The VP **418** may be used by the CPU **421** to combine information from the PC **135** with a TV signal **455** for display on the TV **102a** or select between the two for display. The data from the VP **418** may be represented in RGB format wherein a first portion of the data represents red information, a second portion represents green information, and a third portion represents blue information. The VP **418** may be implemented with a YVG606 Video Processor manufactured by Yamaha Inc.

The wireless IR sensor **414** receives user commands from the remote control **105a**. The wireless IR sensor **414** provides the user commands from the remote control **105a** to the CPU **421** for processing. The user commands can be processed by the CPU **421** as a serial data stream.

The PC **135** examines the request from the set-top box **100a** to determine which set-top box **100a-b** is requesting the information. In one embodiment, a computer program running on the PC **135** handles the requests from the set-top boxes **100a-b** in an integrated fashion. For example, the computer program can record each request and the ID of the set-top box **100a-b** which made the request in a table or using other techniques known to those having skill in the art. The computer program may cause the PC **135** to access the requested information and broadcast the requested information and the ID associated with the request over the cable **117**. For example, if the computer program determines that the requested information should be accessed via the Internet, the computer program causes the PC **135** to access and request the information from the

Internet. When the requested information is provided to the computer program from the Internet, the computer program looks up the request in the table to determine which set-top box **100a-b** requested the information and broadcasts the requested information and the associated ID on the cable **117**.

Requests from the set-top box **100a-b** are handled in view of the context in which the requests are made. For example, if the first set-top box **100a** is presently displaying an e-mail session, subsequent requests are handled in the context of an e-mail session. In particular, the screen being currently displayed by the set-top box **100a** and the keyboard input can be included in the context of the requests.

The computer program can combine requests from multiple set-top boxes **100a-b** to the network. For example, if a first set-top box **100a** sends a first request for first information and a second set-top box **100b** sends a second request for second information, the computer program combines the two requests into a single request to the network **130** using techniques known to those having skill in the art.

In another embodiment of the present invention, the PC **135** instantiates a plurality of computer programs, wherein each of the plurality of computer programs instantiated is associated with one of the set-top boxes **100a**. In this embodiment, an interface program running on the PC **130** interfaces the plurality of computer programs to the network **130**. For example, in a situation where the first and second set-top boxes **100a-b** are being used, respective first and second computer programs are instantiated to handle requests from the set-top boxes **100a-b**. Accordingly, when the first and second set-top boxes **100a-b** request information from the network **130**, the interface program coordinates access to the network **103**.

According to **FIG. 5**, the PC **135** can be a computer capable of running a wide range of applications software and may include a CPU **542**, a memory **541**, a network interface **543**, a hard disk drive **540**, an interface **531**, a keyboard **539**, a monitor **538** and other hardware and software components commonly found in personal computers. For example, the PC **135** may be implemented using a Pentium microprocessor marketed by Intel running the Windows 98 Operating System marketed by Microsoft Inc. The PC **135** processes the requests for information received from the set-top boxes **100a-b** over the cable **117** via the CTI **110c**, and accesses the requested information which is broadcast

over the cable **117** through the CTI **110c**. In addition, other processing systems such as workstations, mainframes, mini computers, and/or custom systems can be used.

Requests by the set-top boxes **100a-b** and information broadcast by the PC **135** can be structured in a packet format as illustrated in **FIG. 6**. Accordingly, requests for the set-top boxes **100a-b** can be referred to as request packets, and requested information broadcast by the PC **135** can be referred to as information packets. The packet format of **FIG. 6** can include a START byte, an ID word, an INSTR byte, a LENGTH word, a number of DATA bytes, a CKSUM word, and a STOP byte. The Start byte can signal the start of the packet. In a particular embodiment, the START byte can be the value FF_{16}. The ID word corresponds to the ID associated with the set-to box **100a-b**. In one embodiment, the ID word can be the least significant word of the serial number of the set-top box.

The INSTR byte can be an instruction or command to be executed by the set-top box **100a**. The LENGTH word can be the number of bytes contained in the DATA field. The DATA can be a number of data bytes associated with the INSTR field. For example, if a particular command or instruction has associated data or parameters, the data is stored in the DATA field. The number of data bytes included in the DATA field is described by the LENGTH field. The CKSUM can be the least significant word of the sum of each byte contained in the INSTR, LENGTH, and DATA fields. The STOP byte can signal the end of the packet. In a particular embodiment, the STOP byte is the value FF_{16}.

FIG. 7 is a flowchart that illustrates initialization operations of the set-top box according to the present invention. When the user powers the set-top box up (block **700**) a self test can be performed (block **705**). The ID of the set-top box can be determined and a power-up packet can be sent to the PC (block **715**). The power-up packet can signal the PC that the set-top box has been turned on and may provide requests for information. The set-top box can wait for an acknowledgement packet from the PC (block **720**). The acknowledgement packet can signal the set-top box that the power-up packet was recognized by the PC.

When the acknowledgement packet is received from the PC (block **725**), the set-top box begins processing requests from the user for information to be displayed and begins processing information packets broadcast by the PC (block **730**).

FIG. 8 is a flowchart that illustrates initialization operations of a computer program running on the PC **135** in coordination with the initialization operations illustrated in **FIG. 7**. The computer program begins processing incoming requests from the set-top boxes in block **800**. A determination is made as to whether an incoming packet is a power-up packet from a set-top box (block **805**). If the incoming packet is not a power-up packet, the packet is processed as a request packet from a known set-top box as shown in **FIG. 9** (block **810**).

If the packet is a power-up packet, the ID associated with the power-up packet is determined (block **815**) and the ID is compared to the IDs of all known set-top boxes (block **820**). If the ID included in the power-up packet is the same as an ID associated with a known set-top box, operations continue with the processing of incoming request packet (block **810**). If the ID included in the power-up packet is not known, the ID is recorded as an ID associated with a known set-top box and a computer program according to the present invention is instantiated (block **825**). In particular, request packet from the set-top box associated with the ID included in the power-up packet above are handled by the instantiated computer program. Accordingly, a computer program may be instantiated for each known set-top box. A power-up acknowledgement packet is broadcast on the communications link (block **830**) and the operations continue, wherein a determination is made as to whether an incoming packet is a power-up packet from a set-top box (block **805**).

FIG. 9 is a flowchart that illustrates operations of a set-top box in response to requests for information. According to **FIG. 9**, the set-top box begins processing input at block **900**. The set-top box waits for a command from the remote control (block **910**). When a remote control command is detected (block **910**), the set-top box determines if the requested information is resident in the set-top box (block **915**). If the information is resident in the set-top box, the set-top box sends the requested information to the TV (block **925**). If, however, the requested information is not resident in the set-top box, the

set-top box sends a request for the information, including the ID of the set-top box, to the PC (block **920**).

FIG. 10 is a flowchart that illustrates operations of a computer program running on the PC in response to incoming request packets for information from the set-top boxes. According to **FIG. 10**, processing begins at block **1000**. An incoming request for information is decoded (block **1010**) and the ID included in the request is determined (block **1020**). If the ID included in the request is not associated with a known set-top box (block **1030**), the request is not accepted and processing continues at block **1010**.

If, however, the ID included in the request is associated with a known set-top box (block **1030**), the request is accepted and provided to the computer program instantiated to handle requests from the set-top box associated with the ID included with the request (block **1040**). When the requested information is received (block **1050**), the requested information is broadcast over the communications link (block **1060**) and processing continues at block **1010**.

FIG. 11 is a flowchart that illustrates operations of a set-top box in response to information broadcast by the PC. According to **FIG. 11**, the processing of incoming packets from the PC begins in block **1100**. When a packet is received from the PC (block **1110**), the ID included in the packet is compared to the ID of the set-top box (block **1120**).

If the ID included in the packet is not equal to the ID of the set-top box (block **1130**), the packet is not accepted by the set-top box. The set-top box waits for another incoming packet from the PC (block **1110**). If the ID included in the packet is equal to the ID of the set-top box (block **1130**), the packet is accepted and the requested information is provided to the TV (block **1140**) and processing continues at block **1010**.

An embodiment of the cable transfer interface **110a** will now be described in greater detail. According to **FIG. 1**, data is transferred between the PC **135** and the set-top box **100a** over the transmission line **130**, such as a coaxial cable, used to conduct a television signal. The set-top box **100a** controls the display of a television **102** in response to commands issued by a user to the set-top box **100a**. Some commands may cause the set-top box **100a** to request information, such as broadcast times, from the PC

135. In response, the PC **135** may retrieve the information from the network **103** and transmit the information to the set-top box **100a**.

Although the embodiment of **FIG. 1** shows the PC **135** connected to the set-top box **100** via the transmission line **130**, it will be understood that other devices may be used. For example, in another embodiment, two PCs may be connected via the transmission line **130** to allow the transfer of serial data between the PCs. In still another embodiment, the cable transfer interface can be powered by a separate DC power supply.

Data is transferred between the PC **135** and the set-top box **100a** in a half-duplex fashion that may be controlled by a computer program running on one or more processors. For example, the PC **135** and the set-top box **100a** may each include one or more processors that run computer programs to coordinate the transfer of data over the transmission line **130**. In operation, a transmission by either the PC **135** or the set-top box **100a** may stop to allow the other device to transmit. The half-duplex control of the PC **135** and the set-top box **100a** can be performed according to techniques known to those having skill in the art. The transmission line **130** includes the splitters **115 a-d** that distribute the television signal **127** to the plurality of devices via cables **117** as shown in **FIG. 1**. The transmission line **130** can include conventional cabling such as that installed in the walls and floors of houses.

For simplicity, the transmit operation is described first, wherein data is transmitted from the set-top box **100a** to the PC **135** such as when the user requests programming information to be displayed. Second, a receive operation is described in which data is transmitted from the PC **135** to the set-top box **100a** such as when the PC **135** responds to the request by transferring the program information to the set-top box **100a**.

In the transmit operation, the set-top box **100** can transmit data to the first cable transfer interface (CTI) **110a** using an interface format such as an RS-232 serial interface standard, although other interface formats may be used as well. In one embodiment, a 9-pin serial data port on the set-top box **100** can be used to transmit and receive the data.

The first cable transfer interface **110a** can process the data received from the set-top box **100** using frequency shift keying modulation to provide a modulated data signal which is transmitted over the transmission line **130** which also conducts the television

signal **127**. However, the modulated data signal occupies a frequency range that is not within the television signal frequency range used to conduct the television signal.

The data transmitted by the first cable transfer interface **110a** is transferred to the PC **135** through splitters **115a, c, d**. The splitter **115d** distributes the television signal **127** to the televisions **102a-c**, the first and second cable transfer interfaces **110a, c** and the set-top boxes **100a-b** via the cable **117**. Consequently, the cable **117** conducts a distributed version of the television signal **127** and the data transmitted by the first cable transfer interface **110a**. Other devices, such as videocassette recorders or other devices known in the art may be used in place of the televisions **102**.

A second cable transfer interface **110c** can process the data transmitted by the first cable transfer interface **110a** to provide data to the PC **135** according to the interface format described above. In one embodiment, a 9-pin serial data port on the PC **135** can be used to transmit and receive data between the PC **135** and the second cable transfer interface **110c**.

In the receive operation, data can be transmitted from the PC **135** to the set-top box **100a**, such as when the PC **135** responds to the request transmitted by the set-top box **100a**. In particular, data can be transmitted from the PC **135** to the second cable transfer interface **110c** according to the interface format described above. The second cable transfer interface **110c** can process the data to provide a second modulated data signal that is transmitted over the transmission line **130** to the first cable transfer interface **110a**. The first cable transfer interface **110a** demodulates the data received from the PC **135** and provides data to the set-top box **100a** according to the interface format. The set-top box **100a** uses the data to control the display of a distributed version of the television signal **127** on the television **102a** provided to the set-top box **100a**. In another embodiment, the same cable can be used to provide the distributed version of the television signal **127** and the data to the first cable transfer interface **110a** and the set-top box **100a**.

Accordingly, cabling installed in houses can be used to transfer data between devices, such as PCs and set-top boxes. For example, existing cabling can be used to connect a PC with a set-top box, thereby allowing data to be transferred between the set-top box and the PC. Moreover, the data transfer does not interfere with the television signal conducted over the same cable. The cabling can be installed in the floors and

walls of the house, thereby making the connection between the devices less cumbersome and less expensive than adding a dedicated cable between the devices.

FIG. 12 is a block diagram of a cable transfer interface **110** according to the present invention. In a transmit operation the data formatted according to the interface format can be received by a converter **200** which converts the received data to Complementary Metal Oxide Semiconductor (CMOS) or Transistor to Transistor Logic (TTL) voltage levels (such as 0-5 volts) to provide a transmit format data signal. A transmitter **205** can process the transmit format data signal using Frequency Shift Keying (FSK) modulation to provide the transmit modulated data signal. The FSK modulation can be performed using a frequency range that is not within a television signal frequency range used to conduct the television signal **127** over the transmission line **130**. For example, in one embodiment the FSK modulation is performed using frequencies in a range between about 800KHz and 1MHz.

The transmit modulated data signal can be provided to a switch **210** that electrically couples the transmit modulated data signal to the transmission line **130** under the control of the data provided to the cable transfer interface **110**. For example, a Ready To Send (RTS) signal included in an RS-232 interface can be used to control the switch direction to electrically couple the transmit modulated data signal to the transmission line **130**.

The transmitter **205** can include an FSK modulator **220** that provides a modulated data signal using a frequency range that is not within the television signal frequency range used to conduct the television signal **127** over the transmission line **130**. The FSK modulator **220** generates the modulated data signal at a frequency based on information included in the transmit format data signal. For example, in one embodiment the FSK modulator **220** generates the modulated data signal at a frequency of 800KHz upon detecting that the transmit format data signal is equal to a logical 0. When the transmit format data signal transitions to a logical 1, the FSK modulator **220** generates the modulated data signal at a frequency of 1MHz.

The modulated data signal is provided to a transmit interface **225** that provides the transmit modulated data signal to the switch **210**. In particular, the transmit interface **225** drives the transmit modulated data signal over the transmission line **130** via the switch

210 to compensate for a variety of transmission line **130** configurations. For example, the transmit interface **225** may drive the transmit modulated data signal over a 200-foot transmission line **130** with an impedance in a range between about 25 ohms and 75 ohms.

In a receive operation data is transferred over the transmission line **130** to the switch **210** which electrically couples the data from the transmission line **130** to receiver **215** under the control of the data provided to the cable transfer interface **110** to provide a receive modulated data signal. For example, a Ready To Send (RTS) signal included in an RS-232 interface can be used to control the switch direction to electrically couple the data from the transmission line **130** to the receiver **215**.

The receiver **215** processes the receive modulated data signal to provide a demodulated data signal to the converter **200**. In particular, the receiver **215** processes the receive modulated data signal using FSK demodulation over a frequency range that is not within a television signal frequency range used to conduct the television signal **127** over the transmission line **130** to provide a receive format data signal.

The converter **200** converts the receive format data signal to the interface format as described above. For example, in one embodiment the receive format data signal can be converted from CMOS voltage levels to RS-232 voltage levels.

The receiver **205** can include a receive interface **230** that matches the impedance of the cable transfer interface **110** to the transmission line **130** to provide a receive modulated data signal. For example, in one embodiment, the receive interface **230** can provide a 75 ohm termination for the transmission line **130**. The receiver **205** also includes an FSK demodulator **235** that provides a demodulated data signal using a frequency range that is not within the television signal frequency range used to conduct the television signal **127** over the transmission line **130** to provide the demodulator data signal. For example, in one embodiment the FSK demodulator **235** generates a logical 0 upon demodulating the modulated data signal at a frequency of 800KHz. The FSK demodulator **235** generates a logical 1 upon demodulating the modulation data signal at a frequency of 1Mhz.

FIG. 13 is a schematic diagram of an exemplary embodiment of a cable transfer interface **110** according to the present invention. According to **FIG. 13**, data can be transmitted to/from the cable transfer interface **110** via connector **300**. The data is

converted to/from CMOS voltage levels from/to RS-232 voltage levels by an interface format chip **305** such as a MAX232CWE marketed by Maxim, Inc. The CMOS level data is processed by the FSK modulator **310** to provide a transmit modulated data signal. The FSK modulator **310** may be a Monolithic PLL XR0215ACD marketed by Exar, Inc.

The transmit modulated data signal is driven over the transmission line **130** by the transmit interface **225**. The transmit interface **225** can include a transistor **Q1** and resistors **R14** and **R15** in an emitter follower configuration. The emitter follower configuration can allow the transmit interface to drive the transmit modulated data signal over the transmission line **130** up to 200 feet at an impedance in the range of about 25 ohms to 75 ohms.

The transmit modulated data signal can be provided to a switch **320** which couples the transmit modulated data signal to the transmission line **130** during a transmit operation. The switch **320** may be an analog switch PI5A383AW marketed by Pericom, Inc. The switch **320** also can couple data from the transmission line **130** to FSK demodulator **325** via the receive interface **230** during a receive operation to provide the receive modulated data signal. The direction of the switch **320** is controlled by an RTS signal generated at pin 9 of the interface format chip **305**. For example, the RTS signal indicates that a device is ready to send data. Accordingly, the direction of the switch **320** is set to receive data from the device sending the RTS signal.

The FSK demodulator **325** can demodulate the receive modulated data signal to provide a demodulated data signal. The FSK demodulator **325** may be a Monolithic PLL XR0215ACD marketed by Exar, Inc. The demodulated data signal may have an amplitude of about 200mV.

The demodulated data signal can be compared to a reference voltage (controlled by potentiometer R32) by the comparator **330**. The comparator **330** shifts the voltage level of the demodulated data signal to CMOS voltage levels to provide the receive format data signal. The comparator **330** may be a Voltage Comparator LM311M marketed by National Semiconductor, Inc. The receive format data signal is provided to the interface format chip **305** for conversion to RS-232 voltage levels upon which data is transmitted over the connector **300**.

Accordingly, cabling installed in houses can be used to transfer data between devices, such as PCs and set-top boxes. For example, existing cabling can be used to connect a PC with a set-top box, thereby allowing data to be transferred between the set-top box and the PC. Moreover, the data transfer does not interfere with the television signal conducted over the same cable. The cabling can be installed in the floors and walls of the house, thereby making the connection between the devices less cumbersome and less expensive than adding a dedicated cable between the devices.

In addition, set-top boxes can be identified by respective IDs. The set-top boxes can send requests for information over a communications link to a PC. The requests can include the ID of the set-top box that made the request. When the requested information is accessed by the PC, the requested information and the ID of the set-top box that made the request are transmitted over the communications link to the set-top box. Accordingly, multiple set-top boxes may access information from a single residence via an existing PC, thereby allowing a more cost-effective approach than conventional systems.

In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims.

What is Claimed is:

1. A method of providing information from a personal computer to a set-top box over a television signal transmission line, the method comprising the steps of:

receiving a request for information from the set-top box at the personal computer, wherein the request includes an ID that identifies the set-top box;

accessing the requested information by the personal computer; and

transmitting the requested information and the ID that identifies the set-top box from the personal computer to the set-top box over the television signal transmission line using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the television signal transmission line.

2. The method of Claim 1 further comprising the steps of:

receiving a second request for second information from a second set-top box at the personal computer, wherein the second request includes a second ID that identifies the second set-top box;

accessing the second requested information by the personal computer; and

transmitting the second requested information and a second ID that identifies the second set-top box from the personal computer to the set-top box over the television signal transmission line using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the television signal transmission line.

3. The method of Claim 1, wherein the step of transmitting comprises the step of transmitting data from a first device to a second device over the television signal transmission line which simultaneously conducts a television signal.

4. The method of Claim 2, wherein the step of accessing comprises the steps of:

accessing the first requested information based on a first context associated with the first set-top box; and

accessing the second requested information based on a second context associated with the second set-top box.

5. The method of Claim 3, wherein the step of transmitting comprises the steps of:

generating a modulated data signal at a frequency that is based on the data; and

transmitting the modulated data signal from the first device to the second device over the television signal transmission line.

6. The method of Claim 2, wherein the step of accessing comprises the steps of:

combining the first request for information and the second request for information at the personal computer; and

accessing the first requested information and the second requested information by the personal computer via a network.

7. The method of Claim 4, wherein the step of accessing comprises the step of accessing the first requested information by the personal computer based on a first keyboard status and a first screen status.

8. The method of Claim 1, wherein the step of transmitting comprises the step of broadcasting a plurality of information packets by the personal computer over the television signal transmission line using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the television signal transmission line.

9. The method of Claim 1, wherein the step of accessing comprises the step of accessing the requested information by the personal computer via a network.

10. The method of Claim 1 further comprising the steps of:

sending a power-up packet including the ID of the set-top box from the set-top box to the personal computer over the communications link from the set-top box;

recording the ID of the set-top box included in the power-up packet at the personal computer to designate the set-top box as known; and

transmitting an acknowledgement packet including the ID of the set-top box from the personal computer over the communications link to the set-top box to acknowledge receipt of the power-up packet from the set-top box.

11. A method of providing information to a set-top box over a communications link, the method comprising the steps of:

receiving a request for information from the set-top box, wherein the request includes an ID that identifies the set-top box;

accessing the requested information; and

transmitting the requested information and the ID that identifies the set-top box over the communications link.

12. The method of Claim 11 further comprising the steps of:

receiving a second request for second information from a second set-top box, wherein the second request includes a second ID that identifies the second set-top box;

accessing the second requested information; and

transmitting the second requested information and a second ID that identifies the second set-top box over the communications link.

13. A method of providing information from a personal computer to a set-top box over a communications link, the method comprising the steps of:

receiving a request for information from the set-top box at the personal computer, wherein the request includes an ID that identifies the set-top box;

accessing the requested information by the personal computer; and

transmitting the requested information and the ID that identifies the set-top box from the personal computer to the set-top box over the communications link.

14. The method of Claim 13 further comprising the steps of:

receiving a second request for second information from a second set-top box at the personal computer, wherein the second request includes a second ID that identifies the second set-top box;

accessing the second requested information by the personal computer; and

transmitting the second requested information and a second ID that identifies the second set-top box from the personal computer to the set-top box over the communications link.

15. The method of Claim 14, wherein the step of accessing comprises the steps of:

accessing the first requested information based on a first context associated with the first set-top box; and

accessing the second requested information based on a second context associated with the second set-top box.

16. The method of Claim 14, wherein the step of accessing comprises the steps of:

combining the first request for information and the second request for information at the personal computer; and

accessing the first requested information and the second requested information by the personal computer via a network.

17. The method of Claim 15, wherein the step of accessing comprises the step of accessing the first requested information by the personal computer based on a first keyboard status and a first screen status.

18. The method of Claim 13, wherein the step of transmitting comprises the step of broadcasting a plurality of information packets by the personal computer over the

communications link, wherein at least one of the information packets includes the ID that identifies the set-top box that requested the information.

19. The method of Claim 13, wherein the step of accessing comprises the step of accessing the requested information by the personal computer via a network.

20. The method of Claim 13 further comprising the steps of:

sending a power-up packet including the ID of the set-top box from the set-top box to the personal computer over the communications link from the set-top box;

recording the ID of the set-top box included in the power-up packet at the personal computer to designate the set-top box as known; and

transmitting an acknowledgement packet including the ID of the set-top box from the personal computer over the communications link to the set-top box to acknowledge receipt of the power-up packet from the set-top box.

21. A set-top box that interfaces to a television and requests information from a personal computer over a communications link, wherein the set-top box is identified by an associated set-top box ID, wherein the set-top box transmits requests for information and the set-top box ID to the personal computer and receives the information and an associated ID from the PC over the communications link.

22. The set-top box of Claim 21, wherein the set-top box accepts the information from the personal computer if the received associated ID identifies the set-top box.

23. The set-top box of Claim 22, wherein the set-top box rejects the information transmitted by the personal computer if the received associated ID does not identify the set-top box.

24. The set-top box of Claim 21, wherein the communications link is a coaxial cable.

25. The set-top box of Claim 21, wherein the set-top box is configured to be coupled to the personal computer in a house.

26. A system that provides information over a communications link, the system comprising:

a set-top box, configured to be coupled to a television, wherein the set-top box transmits requests for information intended for display on the television, wherein the set-top box has an associated ID that identifies the set-top box; and

a personal computer, configured to be coupled to a network and to the set-top box via the communications link, wherein the personal computer receives the requests for information from the set-top box, accesses the requested information and transmits the requested information and the ID associated with the set-top box to the set-top box.

27. The system of Claim 26, wherein the personal computer receives second requests for information from a second set-top box, wherein the second requests include a second associated ID that identifies the second set-top box, and wherein the personal computer accesses the second requested information and transmits the second requested information and the second ID associated with the second set-top box to the second set-top box.

28. The system of Claim 27, wherein the personal computer accesses the first requested information based on a first context associated with the first set-top box and accesses the second requested information based on a second context associated with the second set-top box.

29. The system of Claim 27, wherein personal computer combines the first request for information and the second request for information and accesses the first requested information and the second requested information via a network.

30. The system of Claim 28, wherein the personal computer accesses the first requested information based on a first keyboard status and a first screen status.

31. The system of Claim 26, wherein the personal computer broadcasts a plurality of information packets over the communication link, wherein at least one of the information packets includes the ID that identifies the set-top box that requested the information.

32. The system of Claim 26, wherein the personal computer accesses the requested information via a network if the personal computer determines that the requested information is not stored on the personal computer.

33. A method of transferring data over a television signal transmission line comprising the step of:

transferring the data using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the television signal transmission line.

34. The method of Claim 33, wherein the step of transferring comprises the step of transmitting the data from a first device to a second device over the television signal transmission line which simultaneously conducts a television signal.

35. The method of Claim 33, wherein the step of transferring comprises the step of receiving the data from the television signal transmission line which simultaneously conducts a television signal.

36. The method of Claim 34, wherein the step of transmitting comprises the steps of:

generating a modulated data signal at a frequency that is based on information included in the data; and

transmitting the modulated data signal from the first device to the second device over the television signal transmission line.

37. The method of Claim 34, wherein the step of transmitting comprises the steps of:

converting an interface format data signal to an internal format data signal;

generating a modulated data signal at a frequency based on information included in the internal format data signal;

driving the modulated data signal to compensate for a characteristic impedance of the television signal transmission line to provide a buffered modulated data signal; and

setting a switch direction that electrically couples the buffered modulated data signal to the television signal transmission line.

38. The method of Claim 35, wherein the step of receiving comprises the steps of:

setting a switch direction that electrically couples the data from the television signal transmission line to provide a buffered modulated data signal;

receiving the buffered modulated data signal to compensate for a characteristic impedance of the television signal transmission line;

generating an internal format data signal from the buffered modulated data signal using frequency shift keying demodulation based on a frequency of the buffered modulated data signal; and

converting the internal format data signal to an interface format data signal.

39. The method of Claim 33, wherein the step of transferring comprises the step of transferring the data from a first device in a residence to a second device in the residence.

40. The method of Claim 33, wherein the step of transferring comprises the step of transferring data over a coaxial cable.

41. A method of communicating in a residence via cable installed in the house, the method comprising the step of:

transferring data over the installed cable using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over a television signal transmission line.

42. The method of Claim 41, wherein the step of transferring comprises the step of transmitting the data from a first device to a second device over the installed cable which simultaneously conducts a television signal.

43. The method of Claim 41, wherein the step of transferring comprises the step of receiving the data from the installed cable which simultaneously conducts a television signal.

44. The method of Claim 42, wherein the step of transmitting comprises the steps of:

converting an interface format data signal to an internal format data signal;

generating a modulated data signal at a frequency based on information included in the internal format data signal;

driving the modulated data signal to compensate for a characteristic impedance of the installed cable to provide a buffered modulated data signal; and

setting a switch direction that electrically couples the buffered modulated data signal to the installed cable.

45. The method of Claim 43, wherein the step of receiving comprises the steps of:

setting a switch direction that electrically couples the data from the installed cable to provide a buffered modulated data signal;

receiving the buffered modulated data signal to compensate for a characteristic impedance of the installed cable;

generating an internal format data signal from the buffered modulated data signal using frequency shift keying demodulation based on a frequency of the buffered modulated data signal; and

converting the internal format data signal to an interface format data signal.

46. A cable transfer interface circuit that processes data using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to transmit the television signal over a television signal transmission line.

47. The cable transfer interface circuit of Claim 46, wherein the frequency range is about 800KHz to 1MHz.

48. The cable transfer interface circuit of Claim 46, wherein the television signal transmission line is a coaxial cable.

49. The cable transfer interface circuit of Claim 46, wherein the data is transmitted from a first device in a building to a second device in the building over the television signal transmission line.

50. A cable transfer interface circuit that transmits data from a data interface over a television signal transmission line during a transmit operation and that provides data from the television signal transmission line to the data interface during a receive operation, the data interface circuit comprising:

a converter that converts a first interface format data signal from the data interface to a transmit format data signal during the transmit operation;

a transmitter, responsive to the converter, that provides a transmit modulated data signal based on the transmit format data signal using frequency shift keying during the transmit operation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the television signal transmission line;

a switch, responsive to the transmitter, that electrically couples the transmit modulated data signal to the television signal transmission line during the transmit operation;

wherein the switch electrically couples data from the television signal transmission line to provide a receive modulated data signal during the receive operation;

a receiver, responsive to the switch, that provides a receive format data signal based on the receive modulated data signal to the converter interface during the receive portion using frequency shift keying demodulation in the frequency range that is not within the television signal frequency range used to conduct the television signal over the television signal transmission line; and

wherein the converter converts the receive format data signal to a second interface format data signal during the receive operation.

51. The cable transfer interface circuit of Claim 50, wherein the transmitter comprises:

a frequency shift keying modulator that generates a modulated data signal based on information included in the first interface format data signal; and

a transmit interface, responsive to the frequency shift keying modulator, that transmits the transmit modulated data signal over the television signal transmission line via the switch based on the modulated data signal, wherein the television signal transmission line has an impedance in a range between about 75 ohms and 25 ohms.

52. The cable transfer interface circuit of Claim 50, wherein the receiver comprises

a receive interface that receives data from the television signal transmission line to provide a modulated data signal;

a frequency shift keying demodulator, responsive to the receive interface, that demodulates the modulated data signal to provide a demodulated data signal; and

a level shifter, responsive to the frequency shift keying demodulator, that shifts a voltage level of the demodulated outer signal to provide the receive format data signal.

53. The cable transfer interface circuit of Claim 50, wherein the television signal transmission line is a coaxial cable.

54. The cable transfer interface circuit of Claim 50, wherein the transmitter is located in a building; and wherein data is transmitted over the television signal transmission line to a device in the building.

55. The cable transfer interface circuit of Claim 50, wherein the frequency range is between about 800KHz and 1 MHz.

56. A system for transferring data in a residence, the system comprising:

a cable, installed in the residence, that conducts a television signal and data transfers simultaneously;

a first cable transfer interface, electrically connected to the installed cable, that transfers data over the installed cable using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the installed cable;

a set-top box, electrically connected to the first cable transfer interface, that transfers data to the first cable transfer interface in response to input and distributes a video signal;

a second cable transfer interface, electrically connected to the installed cable, that transfers data over the installed cable using frequency shift keying modulation in the frequency range that is not within the television signal frequency range used to conduct the television signal over the installed cable;

a personal computer, electrically connected to the second cable transfer interface, that transfers data to the second cable transfer interface in response to transfers from the set-top box;

a television, responsive to the set-top box, that displays the video signal; and

a video cassette recorder electrically connected to the installed cable, that records the television signal and provides a recorded video signal to the television.

57. The system of Claim 56, wherein the frequency range is about 800KHz to 1MHz.

58. The system of Claim 57, wherein the cable is a coaxial cable.

59. A system for transferring data in a residence, the system comprising:

a cable, installed in the residence, that conducts a television signal and data transfers simultaneously;

a first cable transfer interface, electrically connected to the installed cable, that transfers data over the installed cable using frequency shift keying modulation in a frequency range that is not within a television signal frequency range used to conduct the television signal over the installed cable;

a set-top box, electrically connected to the first cable transfer interface, that transfers data to the first cable transfer interface in response to input and distributes a video signal;

a second cable transfer interface, electrically connected to the installed cable, that transfers data over the installed cable using frequency shift keying modulation in the frequency range that is not within the television signal frequency range used to conduct the television signal over the installed cable; and

a personal computer, electrically connected to the second cable transfer interface, that transfers data to the second cable transfer interface in response to transfers from the set-top box.

60. The system of Claim 58, wherein the frequency range is about 800KHz to 1MHz.

61. The system of Claim 58, wherein the cable is a coaxial cable.

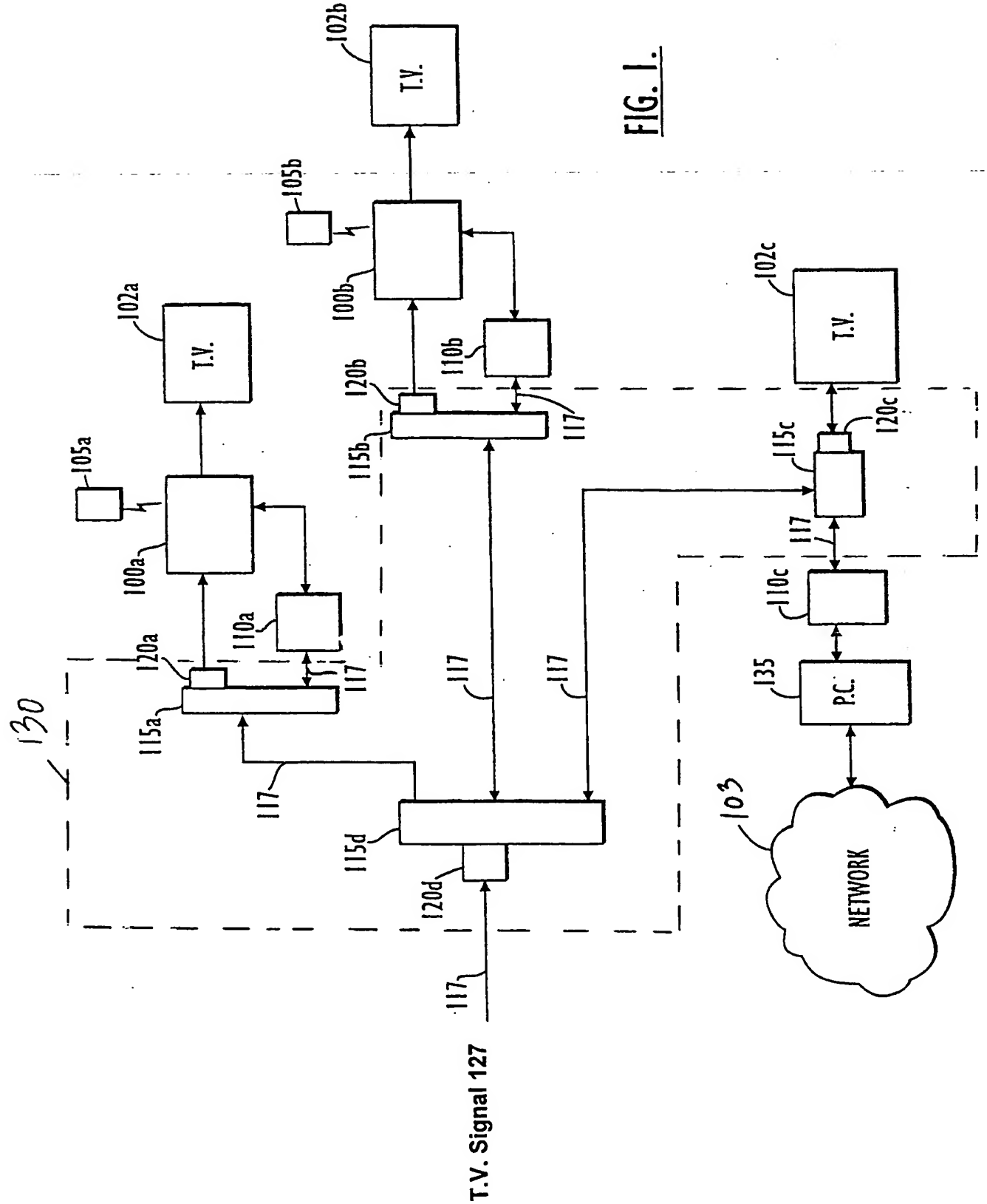
T.V.
102b
105b
100b
110b
120b
115b
117
102a
105a
100a
110a
120a
115a
130
102c
115c
120c
110c
135
P.C.
103
NETWORK
115d
120d
T.V. Signal 127

FIG. 1.

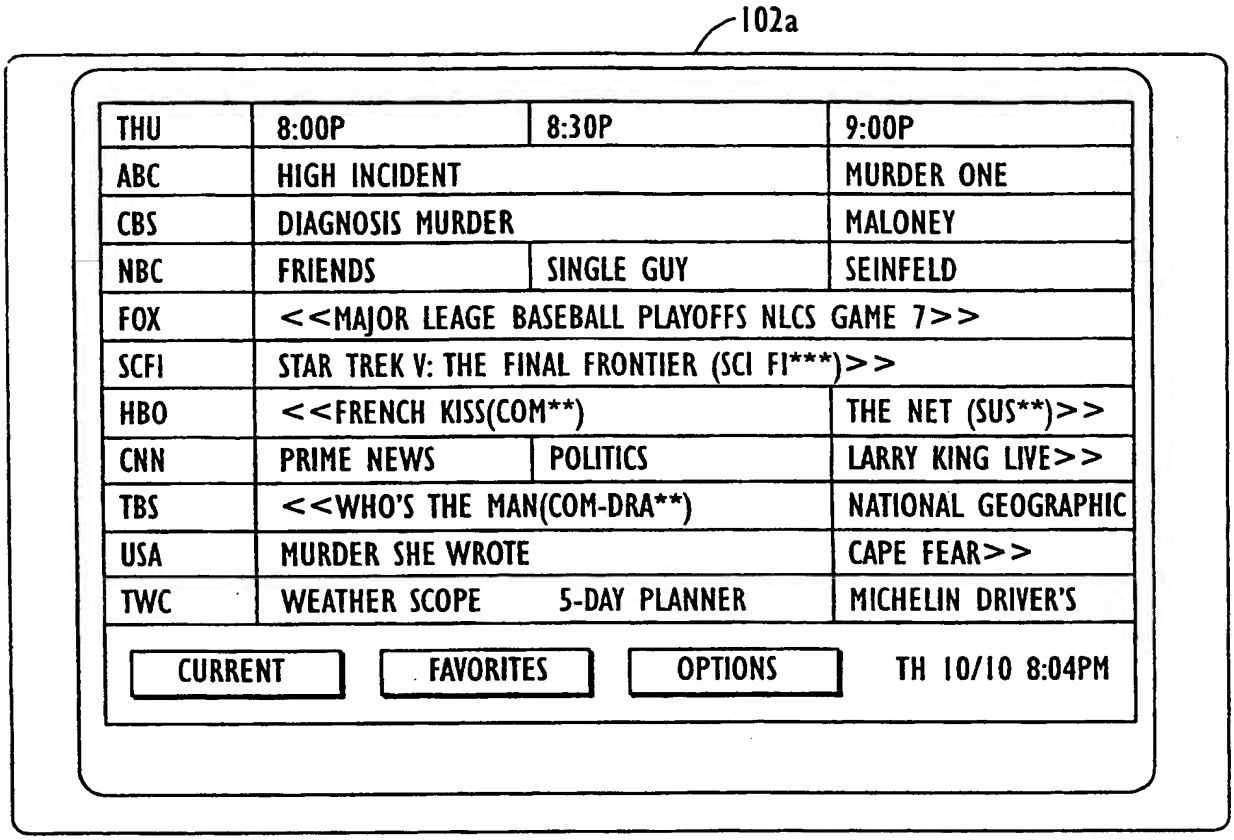
102a
THU
8:00P
8:30P
9:00P
ABC
HIGH INCIDENT
MURDER ONE
CBS
DIAGNOSIS MURDER
MALONEY
NBC
FRIENDS
SINGLE GUY
SEINFELD
FOX
<<MAJOR LEAGE BASEBALL PLAYOFFS NLCS GAME 7>>
SCFI
STAR TREK V: THE FINAL FRONTIER (SCI FI***)>>
HBO
<<FRENCH KISS(COM**)
THE NET (SUS**)>>
CNN
PRIME NEWS
POLITICS
LARRY KING LIVE>>
TBS
<<WHO'S THE MAN(COM-DRA**)
NATIONAL GEOGRAPHIC
USA
MURDER SHE WROTE
CAPE FEAR>>
TWC
WEATHER SCOPE
5-DAY PLANNER
MICHELIN DRIVER'S
CURRENT
FAVORITES
OPTIONS
TH 10/10 8:04PM

FIG. 2.

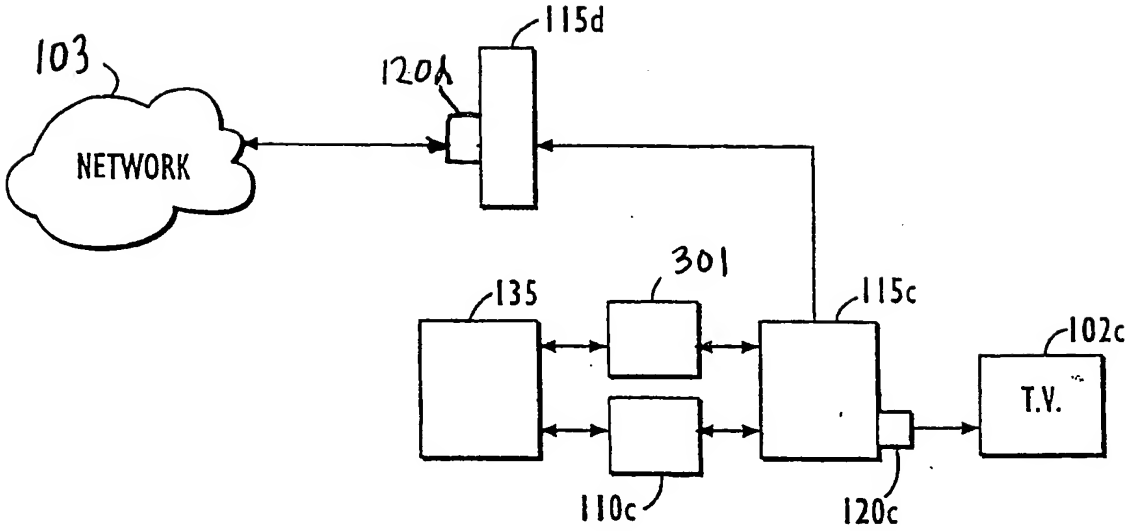

FIG. 3.

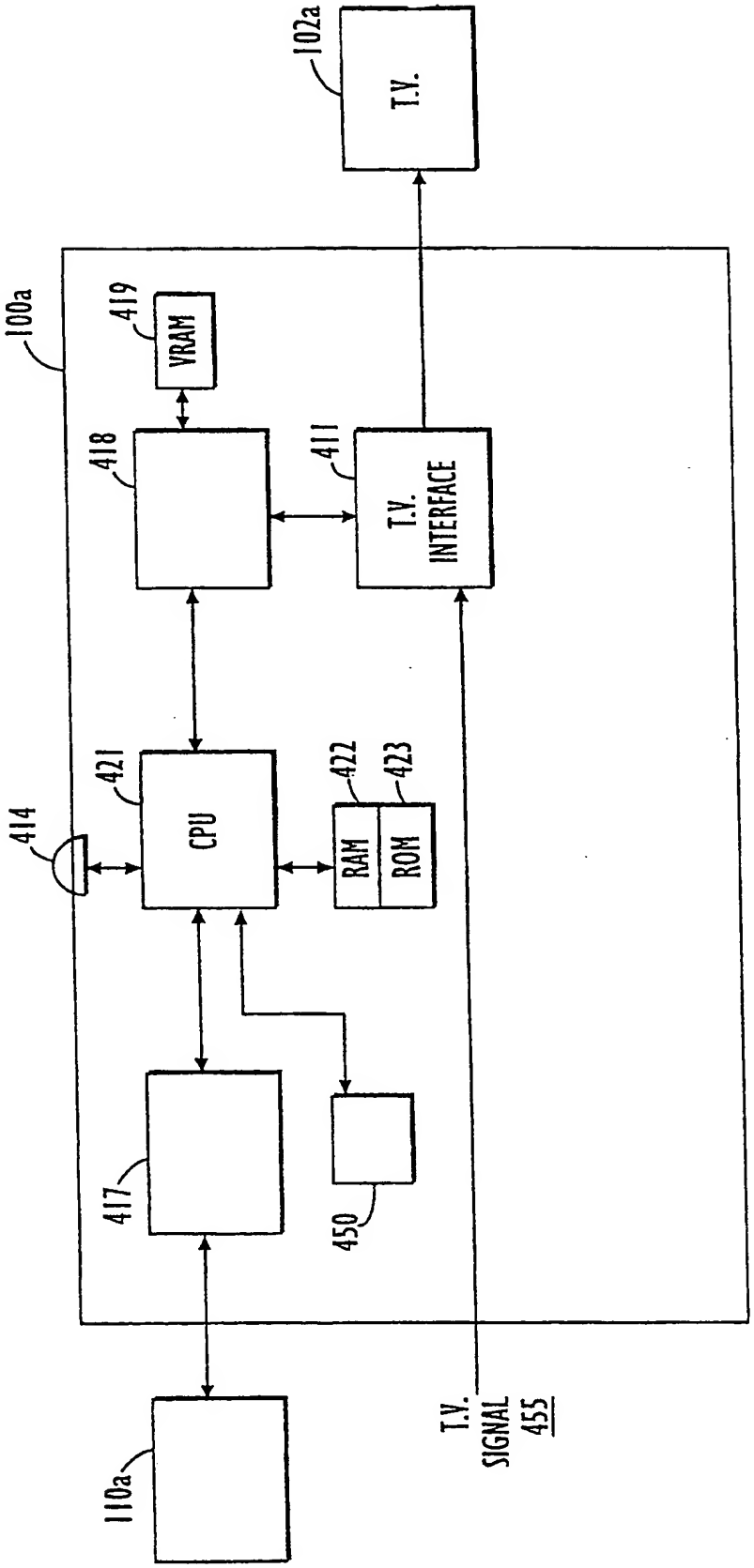
102a
T.V.
100a
419
VRAM
418
411
T.V. INTERFACE
421
CPU
422
423
RAM
ROM
414
417
450
110a
T.V. SIGNAL 455

FIG. 4.

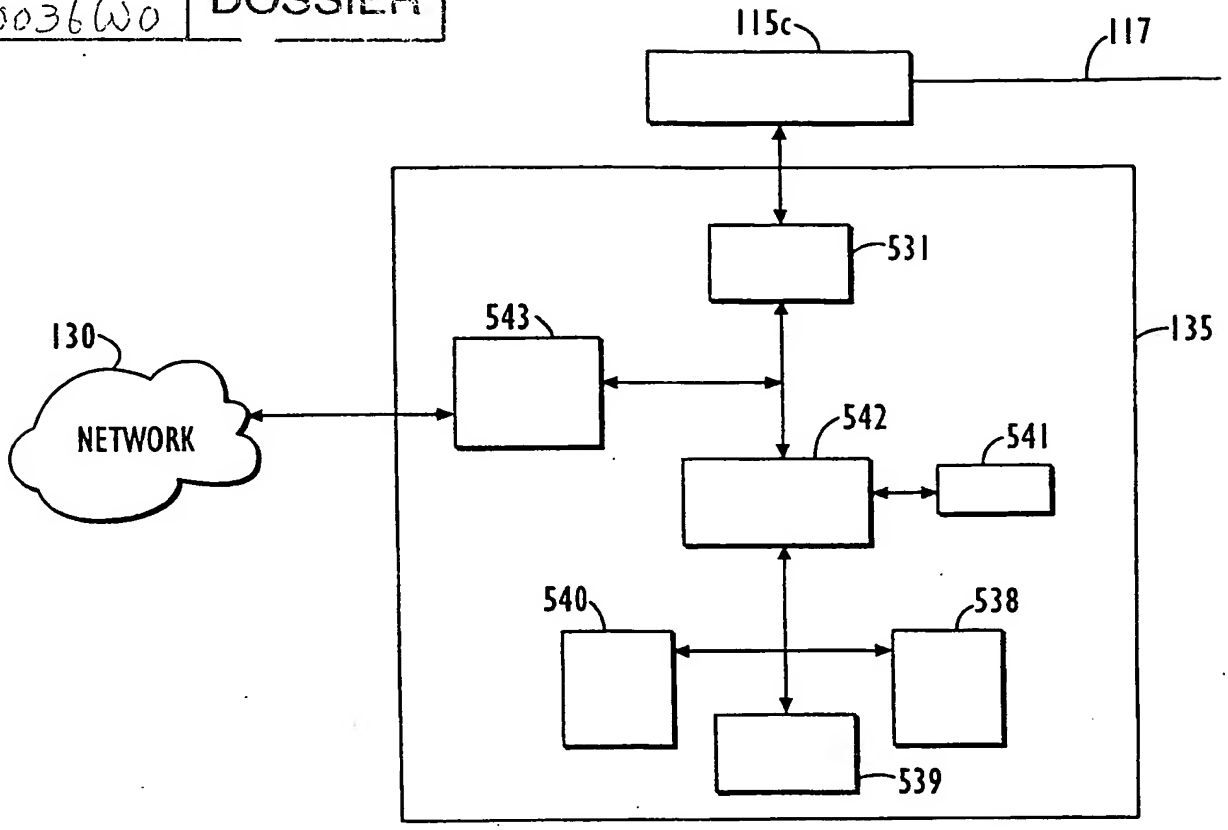

FIG. 5.

PACKET FORMAT

START	ID	INSTR	LENGTH	[DATA]	CKSUM	STOP
BYTE	WORD	BYTE	WORD	nBYTES	WORD	BYTE

FIG. 6.

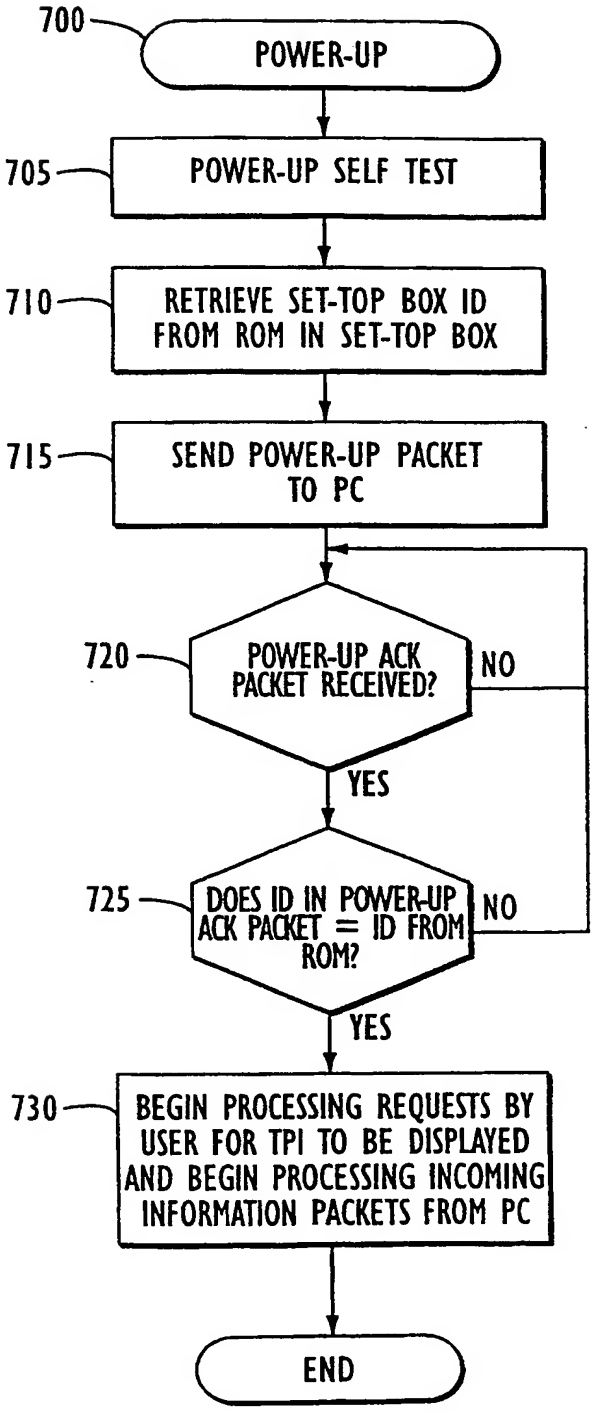
700
POWER-UP
705
POWER-UP SELF TEST
710
RETRIEVE SET-TOP BOX ID FROM ROM IN SET-TOP BOX
715
SEND POWER-UP PACKET TO PC
720
POWER-UP ACK PACKET RECEIVED?
NO
YES
725
DOES ID IN POWER-UP ACK PACKET = ID FROM ROM?
NO
YES
730
BEGIN PROCESSING REQUESTS BY USER FOR TPI TO BE DISPLAYED AND BEGIN PROCESSING INCOMING INFORMATION PACKETS FROM PC
END

FIG. 7.

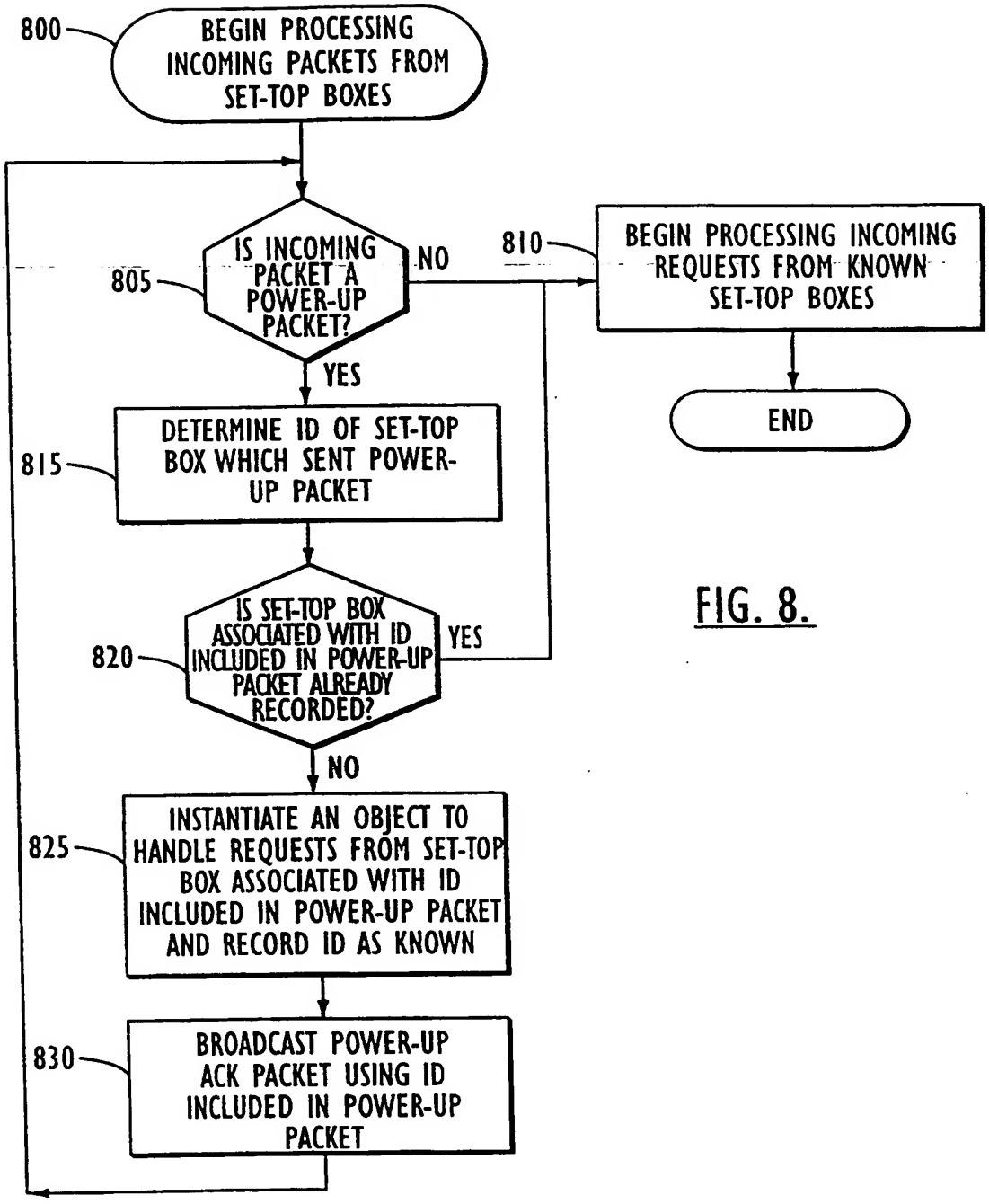
800
BEGIN PROCESSING INCOMING PACKETS FROM SET-TOP BOXES
805
IS INCOMING PACKET A POWER-UP PACKET?
NO
810
BEGIN PROCESSING INCOMING REQUESTS FROM KNOWN SET-TOP BOXES
END
YES
815
DETERMINE ID OF SET-TOP BOX WHICH SENT POWER-UP PACKET
820
IS SET-TOP BOX ASSOCIATED WITH ID INCLUDED IN POWER-UP PACKET ALREADY RECORDED?
YES
NO
825
INSTANTIATE AN OBJECT TO HANDLE REQUESTS FROM SET-TOP BOX ASSOCIATED WITH ID INCLUDED IN POWER-UP PACKET AND RECORD ID AS KNOWN
830
BROADCAST POWER-UP ACK PACKET USING ID INCLUDED IN POWER-UP PACKET

FIG. 8.

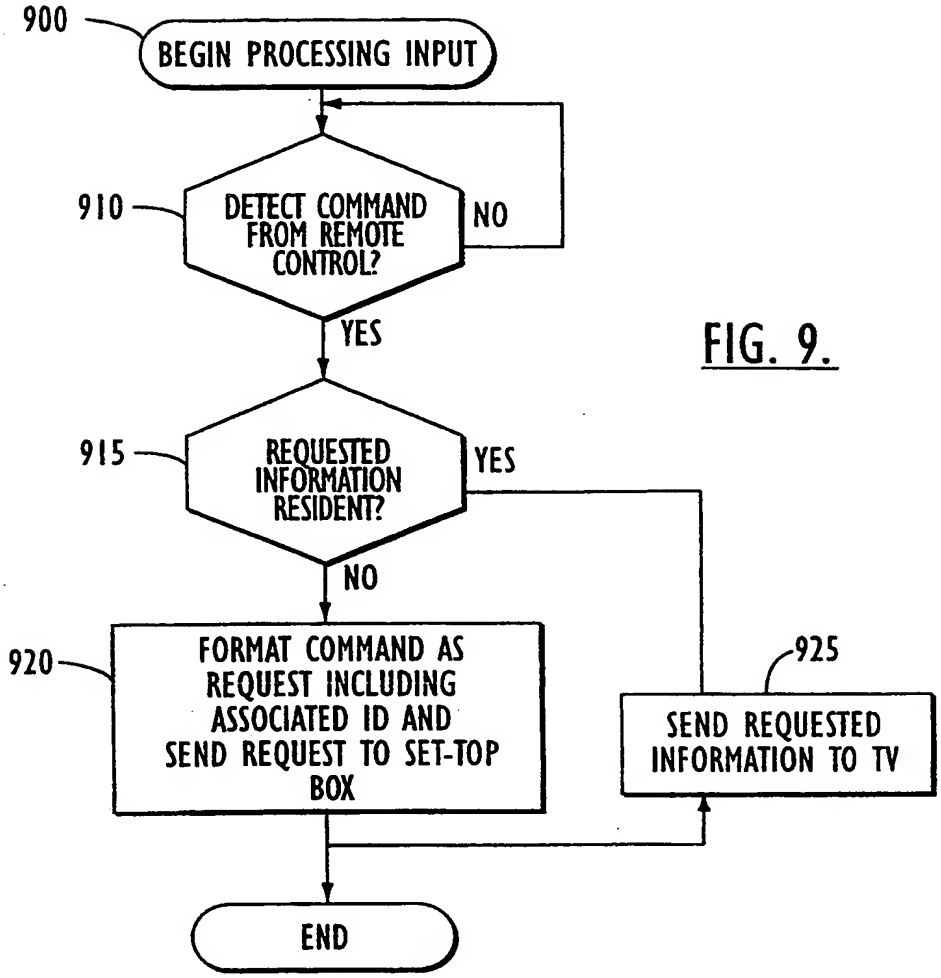
900
BEGIN PROCESSING INPUT
910
DETECT COMMAND FROM REMOTE CONTROL?
NO
YES
915
REQUESTED INFORMATION RESIDENT?
YES
NO
920
FORMAT COMMAND AS REQUEST INCLUDING ASSOCIATED ID AND SEND REQUEST TO SET-TOP BOX
925
SEND REQUESTED INFORMATION TO TV
END

FIG. 9.

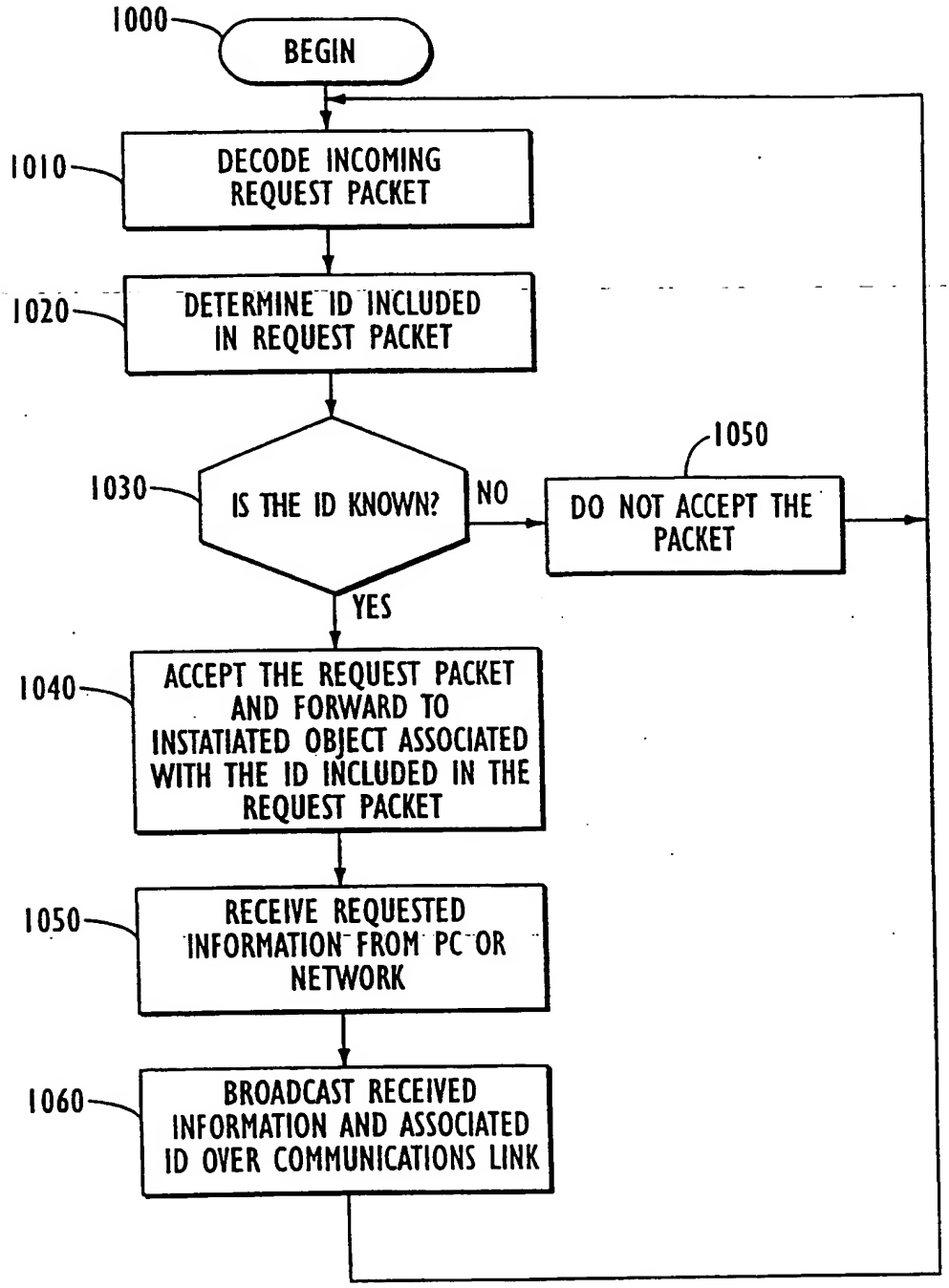
1000
BEGIN
1010
DECODE INCOMING REQUEST PACKET
1020
DETERMINE ID INCLUDED IN REQUEST PACKET
1030
IS THE ID KNOWN?
NO
1050
DO NOT ACCEPT THE PACKET
YES
1040
ACCEPT THE REQUEST PACKET AND FORWARD TO INSTATIATED OBJECT ASSOCIATED WITH THE ID INCLUDED IN THE REQUEST PACKET
1050
RECEIVE REQUESTED INFORMATION FROM PC OR NETWORK
1060
BROADCAST RECEIVED INFORMATION AND ASSOCIATED ID OVER COMMUNICATIONS LINK

FIG. 10.

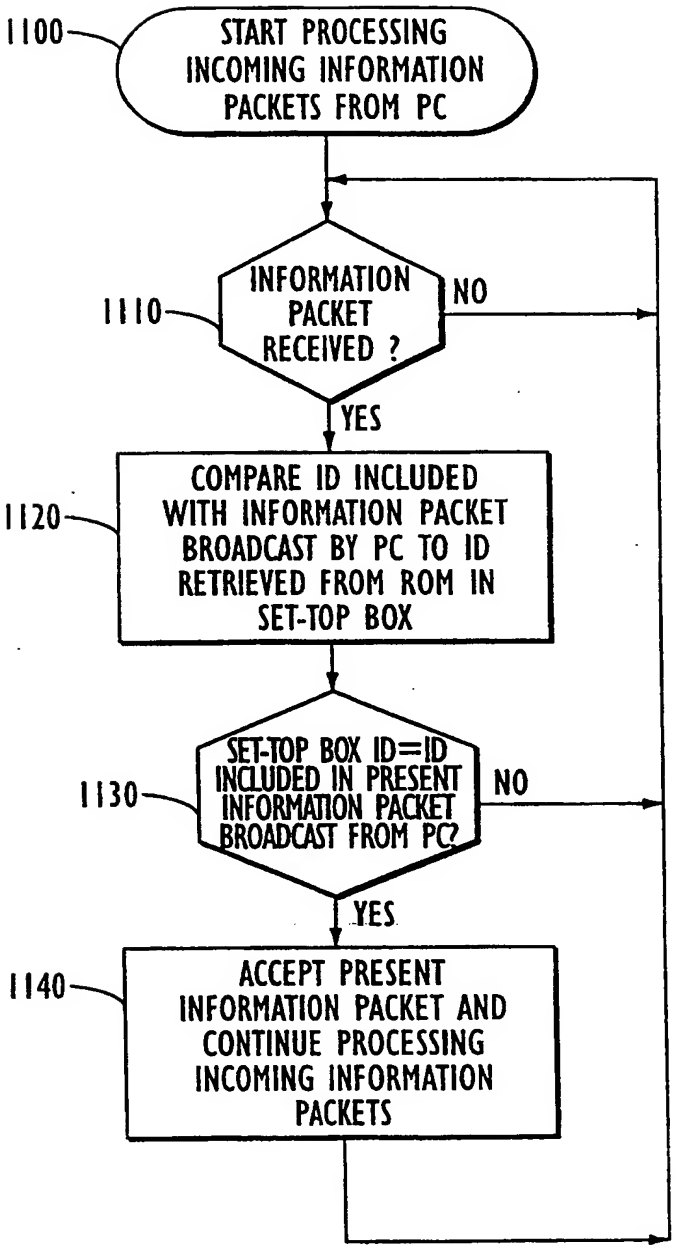
1100
START PROCESSING INCOMING INFORMATION PACKETS FROM PC
1110
INFORMATION PACKET RECEIVED ?
NO
YES
1120
COMPARE ID INCLUDED WITH INFORMATION PACKET BROADCAST BY PC TO ID RETRIEVED FROM ROM IN SET-TOP BOX
1130
SET-TOP BOX ID=ID INCLUDED IN PRESENT INFORMATION PACKET BROADCAST FROM PC?
NO
YES
1140
ACCEPT PRESENT INFORMATION PACKET AND CONTINUE PROCESSING INCOMING INFORMATION PACKETS

FIG. 11.

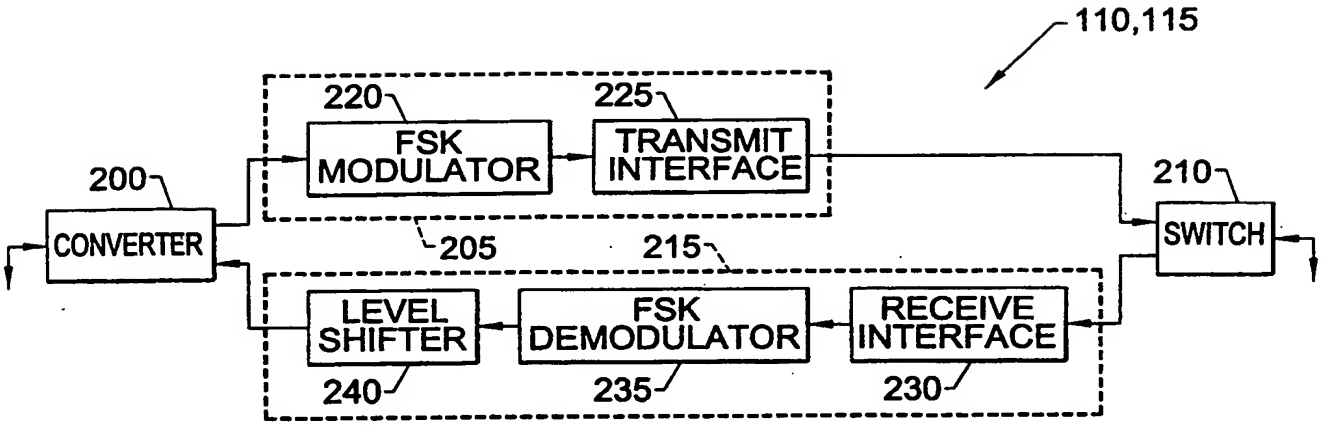
110,115
220
225
FSK MODULATOR
TRANSMIT INTERFACE
200
CONVERTER
205
215
210
SWITCH
LEVEL SHIFTER
FSK DEMODULATOR
RECEIVE INTERFACE
240
235
230

FIG. 12.

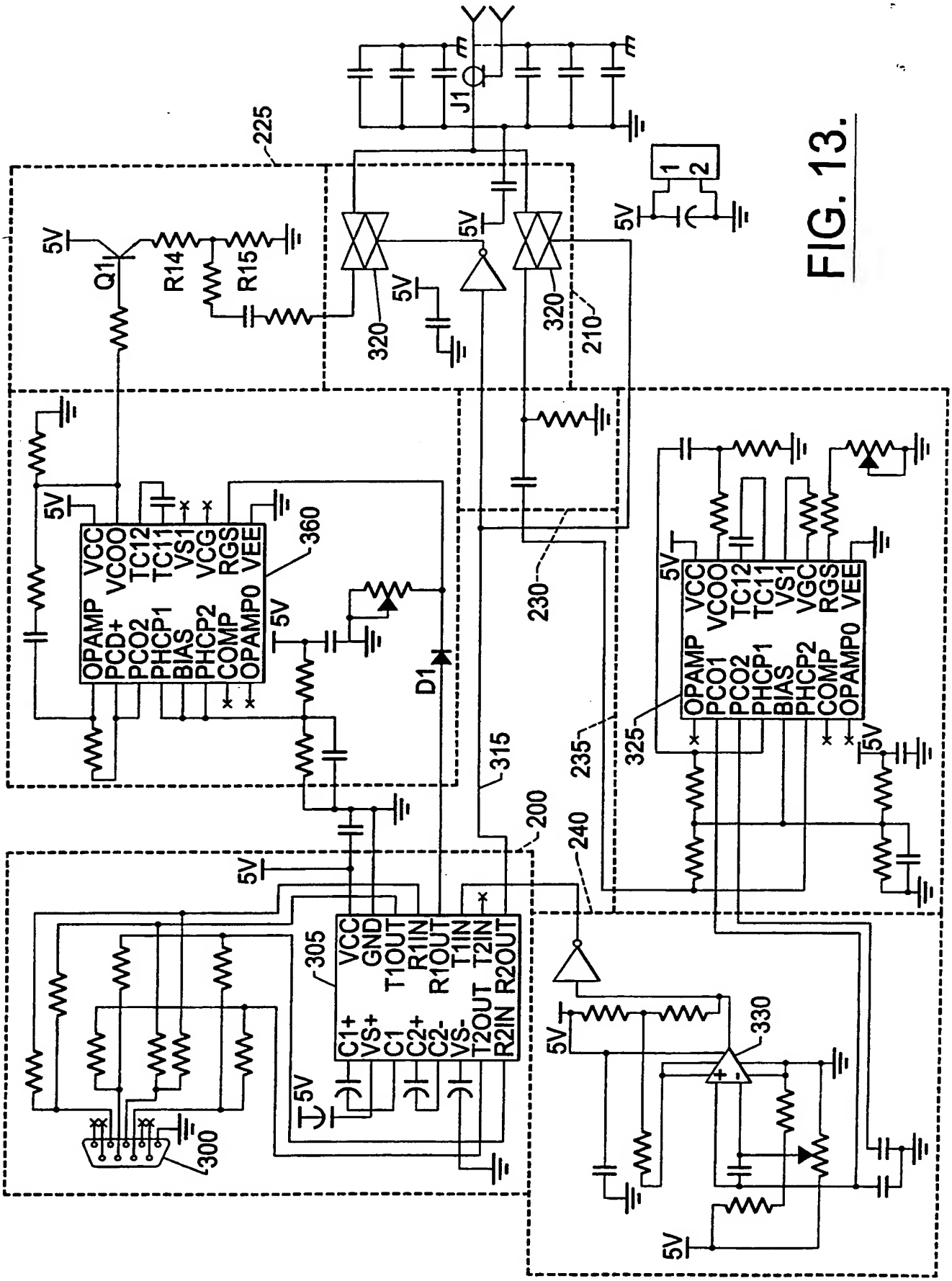
J1
225
1
2
5V
Q1
R14
R15
320
210
230
360
OPAMP
PCD+
PCO2
PHCP1
BIAS
PHCP2
COMP
OPAMP0
VCC
VCOO
TC12
TC11
VS1
VCG
RGS
VEE
D1
315
200
240
235
325
VGC
305
GND
T1OUT
R1IN
R1OUT
T1IN
T2IN
R2OUT
C1+
VS+
C1-
C2+
C2-
VS-
T2OUT
R2IN
300
330

FIG. 13.

INTERNATIONAL SEARCH REPORT

Internati Application No
PCT/US 00/02303

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 255 086 A (MCMULLAN JR JAY C ET AL) 19 October 1993 (1993-10-19) column 5, line 22 -column 7, line 13 column 10, line 15 -column 11, line 32 column 13, line 29 - line 47 abstract; figures 1,3 --- -/--	1-61

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
5 July 2000	13/07/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	La, V

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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A	abstract; figures 1,10	4,7,15, 17,28, 30,37, 38,44, 45,50-61

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A	abstract; claim 1; figure 5	2-10,12, 14-20, 22-25, 27-61

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G.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 13368 A (BRIEN SEAN ANDREW O ;MILNES KENNETH ALAN (US); SCHEIN STEVEN MICHA) 10 April 1997 (1997-04-10) abstract; figure 1	1-61
A	US 5 361 091 A (LAUDER GARY M ET AL) 1 November 1994 (1994-11-01) column 5, line 52 -column 6, line 5 column 6, line 40 - line 45 column 9, line 1 - line 8 column 9, line 52 -column 10, line 15 abstract; figures 1,19	1-61
A	EP 0 727 909 A (SONY CORP) 21 August 1996 (1996-08-21) abstract; figure 1	1-61

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